Eng

OCT 4 1928



MACHINE TOOL EXHIBITION AT OLYMPIA.

# The Engineer.

*Established 1856.* Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXLVI.—No. 3793] LONDON: FRIDAY EVENING, SEPTEMBER 21, 1928 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

## The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.
ARRANGED FOR CARD INDEXING.

The Machine Tool Exhibition at Olympia (Third Report). (P. 306)
THE ENGINEER, 21 - 9 - 28.

The British Association—No. II. (P. 313)
THE ENGINEER, 21 - 9 - 28.

Burning Pulverised Coal. (P. 321)
THE ENGINEER, 21 - 9 - 28.

Boilers for the P. & O. Liner "Viceroy of India." (P. 326)
THE ENGINEER, 21 - 9 - 28.

Standardisation—Its Economic Basis. (P. 323)
(C. LE MAISTRE.) THE ENGINEER, 21 - 9 - 28.

Machine Tools. (P. 319)
THE ENGINEER, 21 - 9 - 28.

A Break-down Crane. (P. 322)
THE ENGINEER, 21 - 9 - 28.

Tank Engines and the Track. (P. 320)
THE ENGINEER, 21 - 9 - 28.

A Large Oil Engine. (P. 324)
THE ENGINEER, 21 - 9 - 28.

**The FOURTH MACHINE TOOL & ENGINEERING EXHIBITION, OLYMPIA, SEPT. 5th-22nd.**
**"THE ENGINEER'S" STAND is No. 39, ROW D, at which all our Friends will be welcome.**

*INDEX TO ADVERTISEMENTS, PAGE 89.*

### PUBLIC NOTICES

**The Director-General,** India Store Department, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—
SCHEDULE 1. 14 GRABS, Circular, Orange Peel Type.
SCHEDULE 2. 7 STEAM WINCHES, 3 Tons.
SCHEDULE 3. 1810 AXLES for Rolling Stock.
SCHEDULE 4. 3658 STEEL TYRES.
SCHEDULE 5. COPPER FIRE-BOX PLATES.
SCHEDULE 6. Three 75 kW OIL ENGINE ALTERNATOR SETS, Water-cooling Plant, Tanks, Switchboard, Cables, &c.
Tenders due on the 28th September, 1928, for Nos. 1 and 2; on the 2nd October, 1928, for Nos. 3, 4 and 5; and on the 2nd November, 1928, for No. 6.
Forms of Tender obtainable from the above at a fee (which will not be returned) of 5s. for each schedule. 9573

**Assistant Engineers** REQUIRED for the PUBLIC WORKS DEPARTMENT of the FEDERATED MALAY STATES for four years' service, after which, subject to satisfactory service, the officers appointed will be eligible for confirmation in the permanent and pensionable establishment. It is probable that the number of permanent appointments will be sufficient for those officers whose services have been entirely satisfactory, but no guarantee can be given. If at the end of four years' service an officer's services have been entirely satisfactory and he is not offered or declines further employment he will be paid a bonus of 2850 dollars. Salary 400 dollars a month, rising to 800 dollars by annual increments of 25 dollars, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 28, must have received a good theoretical training, preferably at a University or College recognised by the Institution of Civil Engineers and possess a Civil Engineering Degree or obtain such other Diploma or Distinction in Engineering as the Secretary of State may decide in any particular case or have completed articles with a civil engineer of good standing, and have passed the examination for Associate Membership of the Institution of Civil Engineers. In addition candidates must have had at least one year's practical experience of civil engineering under a qualified civil engineer.—Apply at once by letter, giving brief details of qualifications and experience and stating age and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W.1, quoting clearly at the head of application M/15224. 9567

**Assistant Engineers (4)** REQUIRED for the KENYA and UGANDA RAILWAY for a tour of 20 to 30 months' service and possible extension. Salary £480, rising to £720 a year by annual increments. Free quarters and passages and liberal leave on full salary. Outfit allowance of £90 on first appointment. Candidates, 22-28 years of age, unmarried, must have passed examination to qualify for Associate Membership of the Institution of Civil Engineers or hold professional qualifications recognised by the Institution as exempting from Parts A and B of that examination, should have had some experience on Railway Civil Engineering Works.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W.1, quoting M/999. 9549

**Assistant Engineers (9)** REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT, for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. The foregoing officers are required to fill vacancies caused by the increase of the establishment of the Nigeria Public Works Department. Salary £480 a year for the first three years; then £510, rising by annual increments to £920. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates must have attained the age of 21½ years on the date of appointment, and should preferably have attained the age of 22½, and must not be over 25 years of age. Must have obtained an Engineering Degree at a recognised University or have passed Sections "A" and "B" of the A.M.I.C.E. examination, or have passed the Associateship in Civil Engineering of the City and Guilds Institute, or possess such other Degree or Diploma or Distinction in Engineering as may be considered satisfactory. Candidates whose qualifying diplomas have been obtained without a college course should have had three years' practical experience of Civil Engineering under a qualified Civil Engineer. It is preferred that all candidates should have had two years' practical experience on good engineering work, subsequent to taking their degree or completing their articles, but under certain conditions this may be waived in the case of candidates in possession of an Engineering Degree.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, S.W.1, quoting M/254. 9435

**Assistant Waterworks Engineers (2)** REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation to the permanent and pensionable establishment. Salary £480 for the first three years, then £510, rising by annual increments to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates must have attained the age of 24 and must not be more than 35. They must have obtained an Engineering Degree at a recognised University or have passed Sections "A" and "B" of the A.M.I.C.E. Examination or the Associateship in Civil Engineering of the City and Guilds Institute, or possess such other Degree, Diploma or Distinction in Engineering as may be considered satisfactory. They must have had experience under a qualified civil engineer on the design of waterworks schemes, and preference will be given to those who have also had practical experience on the construction of such works with engineers or contractors.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W.1, quoting M/950. 9568

### PUBLIC NOTICES

**Waterworks Engineers** (2) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT, for two tours of 12 to 18 months' service, with possible extension. Salary £800, rising by annual increments of £40 to £920 a year; seniority allowance of £72 a year whilst on duty in the Colony. Free quarters, passages and liberal leave on full salary. Candidates, between 30 and 40 years of age, must possess a thorough knowledge of and experience in Design and Construction of Waterworks, and in the Investigation of Water Supplies in the Tropics and elsewhere. Must be Corporate Members of the Institution of Civil Engineers.—Apply at once by letter, stating age, qualifications and particulars of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W.1, quoting M/906. 9587

**Chelsea Polytechnic,**
MANRESA-ROAD, CHELSEA, S.W. 3.
SPECIAL CLASSES IN ENGINEERING METALLURGY.

In addition to the Courses in General Metallurgy, arrangements have been made for Special Courses of Lectures and Practical Work :—
(A) Engineering Metallurgy. Syllabus arranged to cover the syllabus of the Institution of Mechanical Engineers' Associateship Examination in Metallurgy.
(B) Heat Treatment of Metals.
(C) Testing and Mechanical Working of Metals.
The above classes are suitable for Engineers, Consultants, Engineering Students, Works Metallurgists.
COURSES BEGIN 24th SEPTEMBER, 1928.
Full details on application.
Tels., 0899 and 8007 Kensington. 9513

### PUBLIC NOTICES

PATENTS AND DESIGNS ACTS, 1907 TO 1928.
**Notice is Hereby Given that** FELIX HOMBERG, of 19, Hohenstaufenstrasse, Barmen, Germany, SEEKS LEAVE to AMEND the SPECIFICATION of LETTERS PATENT No. 272,380, granted to him for an invention entitled "Improvements relating to the Manufacture of Compositions from Blood."
Particulars of the proposed amendment were set forth in the Illustrated Official Journal (Patents) of the 5th September, 1928.
Any person, or persons, may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton-buildings, London, W.C. 2, within one calendar month from the date of the said Journal.
W. S. JARRATT,
9576 Comptroller-General.

**City of Cardiff Education Committee.**
THE TECHNICAL COLLEGE.
PRINCIPAL : CHARLES COLES, B.Sc. (Lond.).
The SERVICES will be REQUIRED in January next of a FULL-TIME ASSISTANT LECTURER in ENGINEERING, qualified to teach up to Honours B.Sc. standard. The main subjects required will be those of Mechanical and Civil Engineering, but a good knowledge of Electrical Engineering will be a recommendation.
Salary payable according to Burnham Award.
Applications on foolscap paper, stating age, full qualifications, teaching and other experience, and giving copies of not more than three recent testimonials, should reach the Principal (from whom further particulars may be obtained), on or before Saturday, 13th October.
The successful candidate will be required to pass a medical examination by the Authority's Medical Examiner for Teachers at Cardiff before commencing duties, and to contribute under the Teachers (Superannuation) Act, 1925.
JOHN J. JACKSON,
Director of Education.
City Hall, Cardiff. 9567

### PUBLIC NOTICES

**Armstrong College,**
NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.Sc. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.
The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.
Full particulars of the Courses may be had on application to
THE REGISTRAR,
Armstrong College,
8925 Newcastle-upon-Tyne.

**County Borough of Croydon.**
EDUCATION COMMITTEE.
APPLICATIONS are INVITED for (a) TEACHER of 3rd Year MACHINE DESIGN, Tuesdays, 7.30-9.30 p.m.; (b) TEACHER of 3rd Year ENGINEERING CALCULATIONS, Mondays, 7.30-9.30 p.m. Salary 18s. per attendance of 2 hours. Particulars of technical education, practical training, teaching experience, age, and present appointments to be sent to the Principal, Central Polytechnic, Scarbrook-road, Croydon.
R. B. MORGAN,
9583 Education Officer.

**County Borough of Middlesbrough Education Committee.**
CONSTANTINE TECHNICAL COLLEGE.
PRINCIPAL : DOUGLAS H. INGALL, D.Sc., F.I.C. A. Inst. P.
APPLICATIONS are INVITED for the POSITION of HEAD of the DEPARTMENT of ENGINEERING.
Salary £500 per annum, with annual increments of £25 to a maximum of £600 per annum.
Applicants are required to have had works experience in either mechanical or structural engineering in addition to possessing suitable academic qualifications.
Particulars of this appointment and form of application may be obtained on receipt of a stamped addressed foolscap envelope, and applications should reach the undersigned not later than Monday, 8th October, 1928.
W. J. WILLIAMS,
Director of Education.
Education Offices, Middlesbrough,
13th September, 1928. 9556

**Indian State Railways.**
FOUR ASSISTANT ENGINEERS are REQUIRED for service in the Mechanical Engineering Department of the Indian State Railways.
Age, not more than 25 years.
QUALIFICATIONS.
Candidates should have received a good general and technical education, and have passed the Associate Membership examination of the Institution of Civil Engineers, or hold a degree or diploma granting exemption from sections "A" and "B" of this examination; should have served at least 4 years as pupil or apprentice in the Locomotive workshops of a British Railway Company or firm of Locomotive Builders of repute, and at least 1 year in the drawing office, and possess an intimate knowledge of the planning, progressing and costing methods adopted in workshops of up-to-date commercial firms.
SALARY.—Initial salary Rupees 375 a month (plus Rs. 150 overseas pay for an Officer of non-Asiatic domicile). Salary payable from date of landing in India subject to rules in force. Leave, Provident Fund and Gratuity in accordance with the rules applicable to officers of the Indian State Railways.
Agreement for 3 years in first instance, but service to be extensible beyond that period with the consent of both parties concerned.
A first-class passage to India will be provided on appointment.
Application must be made by letter only, and all applicants must state their age, whether married or single, and give full particulars (in chronological order) of their education, training and subsequent experience, stating the names of Railways or Contractors by whom they have been employed, and giving details of the work employed upon, with dates in each case. Details should also be given of any previous experience abroad, together with copy of leaving certificate.
Applications, which should be accompanied by COPIES ONLY of testimonials, must be addressed to the undersigned not later than 5th October, 1928.
Messrs. RENDEL PALMER and TRITTON,
12/15, Dartmouth-street,
9574 Westminster, S.W. 1.

**PUBLIC NOTICES (continued) Page 2.**
**SITUATIONS OPEN, Page 2.**
**SITUATIONS WANTED, Page 2.**
**AUCTIONS, Page 90.**
**BUSINESSES and PREMISES (For Sale, etc.). Page 90.**
**MACHINERY, &c., WANTED, Page 90.**
**EDUCATIONAL, Page 2.**
**PATENTS, Page 4.**
**PARTNERSHIPS, Page 2.**
**AGENCIES, Page 4.**
**FOR SALE, Page 4.**
**WORK WANTED, Page 4.**
**FOR HIRE, Page 4.**

*For Advertisement Rates see Leader Page.*

## PUBLIC NOTICES

### State Electricity Commission
OF VICTORIA, AUSTRALIA,
22-32, William-street,
MELBOURNE,
AUSTRALIA.

TENDERS are HEREBY INVITED for the MANUFACTURE, TESTING, SUPPLY, DELIVERY, ERECTION COMPLETE, and MAINTENANCE of STEEL CHIMNEYS and DUST ELIMINATORS for the Yallourn Power Station, in accordance with Specification No. 28/59.

Copies of Tender form, specification, drawings, &c., will be available upon application to the Agent-General for Victoria, Victoria House, The Strand, LONDON, England.

Charge £1 1s. for three copies of Tender form, conditions of tendering, specification, contract conditions and drawings complete. This charge is returnable under certain conditions as specified in the general conditions of tendering. Extra copies, 10s. 6d. each, not returnable. A preliminary deposit of £50 shall be lodged with Tender.

Tenders on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 12th November, 1928.

The Commission does not bind itself to accept the lowest or any Tender.

W. J. PRICE,
Acting Secretary.
9423

### The Assam-Bengal Railway
COMPANY, Ltd., is prepared to receive TENDERS for—
300 PAIRS WHEELS and AXLES for Carriages and Wagons.

Specifications and Tender forms may be obtained at the offices of the Company, Bishopsgate House, 80, Bishopsgate, E.C. 2. A fee of £1 1s. is charged for each specification, which cannot, under any circumstances, be returned.

Drawings may be had at the cost of the tenderer, by application to Messrs. Hodges Bennett and Co., Ltd., 73, Queen Victoria-street, E.C. 4.

Tenders must be delivered at the Company's Offices not later than Noon on Friday, the 5th October, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
THOS. C. BRETT,
Secretary.
18th September, 1928. 9573

### Truro Port and Harbour.
DREDGER.

The Truro City Council, acting as the Port and Harbour Authority, invite TENDERS for the SUPPLY of a SEA-GOING GRAB HOPPER DREDGER, with a hopper capacity of about 150 tons. Particulars can be obtained from the undersigned, to whom sealed Tenders, endorsed "Dredger," together with description of dredger, &c., should be delivered not later than Noon on Monday, 8th October, 1928.

The Council do not bind themselves to accept the lowest or any Tender.

F. A. BARNES, Assoc. M. Inst. C.E.,
City Engineer and Surveyor.
Municipal Buildings, Truro,
18th September, 1928. 9579

### Wandle Valley Joint Hospital
BOARD
TO CONTRACTORS AND DEALERS IN MACHINERY, &c.

The above Board invite TENDERS for the PURCHASE and REMOVAL of GAS ENGINE, SADDLE BOILER, ELECTRIC BATTERY, DYNAMOS, SWITCHBOARD, &c., at the Isolation Hospital, Beddington Corner, near Mitcham Junction, in accordance with the general conditions prepared by the Board's Surveyor.

Full particulars, together with forms of Tender and permit to view, may be obtained on application to the undersigned, to whom Tenders should be delivered on or before Monday, October 1st, 1928.

ROBT. M. CHART,
Surveyor to the Board.
Lower Green, Mitcham, Surrey. 9559

### Biggleswade Water Supply.
MECHANICAL ENGINEER.

The Biggleswade Water Board and the Biggleswade Rural District Council invite APPLICATIONS from persons who have been trained as Mechanical Engineers for the APPOINTMENT of SUPERINTENDENT of the WATERWORKS. The person to be appointed must not exceed 40 years of age and will have to devote the whole of his time to the duties of his office, the particulars of which can be obtained from the Clerk to the above Authorities. Salary £350, increasing £25 per annum up to £450, and an allowance of £70 per annum for travelling if a motor car or motor cycle is used. The person selected will also be appointed Water Engineer for Sandy Urban District Council at a salary of £50, increasing £5 per annum to £60.

Applications, stating age and particulars of the candidates' career, with copies of three testimonials, must be delivered to the undersigned at his office at Biggleswade, Beds., on or before the 2nd day of October next. Canvassing not allowed.

HENRY CHAUNDLER,
Clerk of the Biggleswade Water Board and the Biggleswade Rural District Council.
9503

### City of Hull.
TO CONTRACTORS.

The Corporation is prepared to receive TENDERS for the ABUTMENTS, FOUNDATIONS and PILING of a NEW OPENING BRIDGE, to be erected at a point where the new Paull-road crosses the Hedon Haven.

Forms of Tender and other particulars may be obtained at the Office of the City Engineer's Office, Guildhall, Hull, on the payment of 1s., which will be returned on receipt of a bona fide Tender. Remittances to be made payable to Mr. F. Steadman, City Treasurer.

Tenders, endorsed "Tender, Bridge over Hedon Haven, Foundations," are to be addressed to the Chairman of the Housing and Town Planning Committee, and delivered at the Town Clerk's Office before Twelve Noon on Monday, 1st October, 1928.

The Corporation does not bind itself to accept the lowest or any Tender.

By Order,
T. THOMAS,
City Engineer.
Guildhall, Hull,
19th September, 1928. 9589

### City of Nottingham.
WATER DEPARTMENT.

The Water Committee invite APPLICATIONS from properly qualified and thoroughly experienced persons, not exceeding 40 years of age, for the position of DISTRIBUTION SUPERINTENDENT.

Applicants must be men of good education and address, of active habits, have a thorough knowledge of Mainlaying, Waterworks Plumbing, Maintenance and Repairs, Waste Detection, and be accustomed to all duties incidental to the administration of a large Waterworks undertaking.

The successful applicant will be required to devote the whole of his time to the service of the Water Committee, and must be prepared to reside near Castle Waterworks.

The commencing salary will be at the rate of £375 per annum, rising annually, at the discretion of the Committee, by increments of £25, until a maximum of £450 is reached.

Forms of application may be obtained from Mr. F. W. Davies, Engineer and General Manager, Castle Waterworks, Castle Boulevard, Nottingham. Applications, with copies of three recent testimonials, must be delivered to the Water Engineer not later than Wednesday, 31st October, 1928.

Canvassing will disqualify.

W. J. BOARD,
Town Clerk.
Guildhall, Nottingham,
September, 1928. 9566

## PUBLIC NOTICES

### Institution of Gas Engineers.
The Council of the Institution of Gas Engineers is prepared to receive APPLICATIONS for the OFFICE of SECRETARY. The person to be appointed shall devote the whole of his time to the duties of his office, shall possess an intimate knowledge of the gas industry and have acquired considerable executive experience in connection therewith. Commencing salary £800 per annum.

Applications, endorsed "Secretaryship," to be forwarded to the PRESIDENT, the Institution of Gas Engineers, 28, Grosvenor-gardens, London, S.W.

Applications to be received on or before October 9th, 1928. 9571

### Research Association of
BRITISH MOTOR AND ALLIED MANUFACTURERS,
15, BOLTON-ROAD, W. 4.

RESEARCH ASSISTANT REQUIRED. Initial salary £250-£300, according to qualifications.—Apply by letter only, stating age, works experience, and proficiency in languages, mathematics and physical science. 9561

## SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED

FAIRWEATHER and RANGER THANK APPLICANTS for POSITION advertised Sept. 14th, which is now FILLED. P4975 A

WANTED, Energetic Experienced TRAVELLER; must be practical engineer, with established connection outside London area, to represent firm of manufacturing engineers in Steam Engines, Woodworking Machinery, Contractors' Plant, and General Engineering Work. Resident South or South-West England. State fullest particulars, references, age, salary.—Address, 9519, The Engineer Office. 9519 A

WANTED IMMEDIATELY, YOUNG ENGINEER, age 21-25, who can prove ability and willingness to take extreme care with every detail of his work. Thorough training in workshops, drawing-office and tool-room essential. Ability to make new designs, erect small plant and organise production on time-saving basis also necessary. Good remuneration and encouragement to young man with initiative and the capacity for taking great pains with everything he does.—Address fully, stating salary required, P4960, The Engineer Office. P4960 A

A LEADING BRITISH ELECTRICAL MANUFACTURING FIRM WISHES to SECURE the SERVICES of a FIRST-CLASS TRANSFORMER ENGINEER. The gentleman appointed will be required to assume the full responsibility for the electrical and mechanical design, and to deal with all engineering questions connected with the largest types of transformers.

Applications, which will be treated confidentially, should state details of previous experience and the salary desired, and be sent to the office of this journal.

The position will give every opportunity for development and scope for initiative in connection with the most important engineering schemes, and should therefore provide the essentials for an interesting and successful career for the person appointed.

Address, 9563, The Engineer Office. 9563 A

CIVIL ENGINEER REQUIRED by Waterworks Engineers in India. Must have good training in design and construction of Municipal Water Supplies and knowledge of Hydraulics and Pumping Equipment. Some electrical and mechanical training will be advantageous. Salary Rs. 750 per month with annual increments of Rs. 50 p.m.; five years' agreement. This is an excellent opportunity for an ambitious and hard working young man.—Address particulars of age, experience, &c., 9562, The Engineer Office. 9562 A

CONTRACTORS' ASSISTANT ENGINEER, London. Building exp. essential. Also YOUTH for Office.—Address, wages and exp., P 4979, The Engineer Office. P4979 A

PRACTICAL ENGINEER REQUIRED, who has specialised in the design and equipment of the latest type of Heavy Continuous Rolling Mills for the steel industry. Applicants should state age and give full details of previous experience.—Address, 9500, The Engineer Office. 9500 A

PROCESS ENGINEER and RATE FIXER REQUIRED for Electrical Instrument Factory. Must have had experience in fixing piecework prices by time study methods. Knowledge of assembly processes for small electrical apparatus essential. State experience, age, and salary required.—Address, 9510, The Engineer Office. 9510 A

TEA PLANTING.—An Important TEA COMPANY has a VACANCY on its European Staff for a YOUNG GENTLEMAN (aged 23-24 and unmarried), with ENGINEERING EXPERIENCE and preferably with a knowledge of CRUDE OIL ENGINES, to become a TEA PLANTER on its gardens in Assam. The position would be under a three years' agreement, commencing from the date of arrival at the gardens, and salary for the first year would be at the rate of Rs. 250 a month, rising by annual increments of Rs. 50 a month to Rs. 350 a month in the third year. Passage to the gardens would be paid by the Company.—Applications should be addressed to Box "ASSAM," care of Davies and Co., 95, Bishopsgate, London, E.C. 2, and should contain full particulars as to age, education, and engineering experience. 9569 A

WANTED AT ONCE, Competent LIFT DRAUGHTSMAN.—Address, stating age, experience, and wages required, 9553, The Engineer Office. 9553 A

WANTED, DRAUGHTSMAN with High-speed Diesel experience.—Address, 9520, The Engineer Office. 9520 A

WANTED, DRAUGHTSMAN, with Shop Experience in Boiler Work; age 24 to 28 years. State experience and wages expected.—Address, P.O. Box 4, Hyde, Cheshire. 9552 A

WANTED, First-class DRAUGHTSMAN for Coventry district. Experienced in Machine Tool Equipment, Plant Lay-out and Operation Process.—Address, stating age, experience, and salary required, 9521, The Engineer Office. 9521 A

CONSTRUCTIONAL ENGINEERS (London) REQUIRE DETAILING DRAUGHTSMEN. Previous similar experience necessary. Permanent positions to suitable applicants. State age, experience, salary required.—Address, 9582, The Engineer Office. 9582 A

WANTED.

**Metallurgical CHEMIST**

Experienced in production Ferro Alloys and Metals. To act as Assistant and Take Charge of Furnaces and Chemical Analyses.

Give full particulars as to age, salary and qualifications. Confidential.

Applications to be addressed to:—

**"CHEMIST," Box 446, Port Elizabeth, South Africa.** 9549 A

## SITUATIONS OPEN (continued)

DESIGNER and CHIEF DRAUGHTSMAN REQUIRED to Take Charge of Drawing-office in Works Manufacturing Accurate Machinery. Must have had considerable Machine Shop experience.—Address, stating age, experience, and salary required, 9539, The Engineer Office. 9539 A

DRAUGHTSMEN, First-class Structural and Mechanical, REQUIRED in London district; must be fully experienced in material-handling Plant Contracts.—Write, stating experience, age, and salary required, to "D.," Box 669, Selis Advertising Offices, Fleet-street, E.C. 4. 9443 A

DRAUGHTSMAN REQUIRED, Aged About 25, experienced in Mechanical Engineering, such as Steam and Diesel Engines, Pumping Plants, Heating, &c.; well educated; highest testimonials.—Address, with particulars of past experience and salary, 9578, The Engineer Office. 9578 A

DRAUGHTSMEN REQUIRED by London Manufacturers, experienced in preparing Plenum Heating and Ventilating Schemes.—Write, giving full particulars, age, experience and salary required, to Box 61, c/o Mather and Crowther, Ltd., 10/13, New Bridge-street, London, E.C. 4. 9568 A

DRAUGHTSMAN REQUIRED, Experienced in the design of Enclosed Steam Engines for traction purposes. Must be fully conversant with modern practice.—Address, stating age, experience, and salary required, 9557, The Engineer Office. 9557 A

DRAUGHTSMAN REQUIRED for Mechanical Handling Machinery; only first-class men, capable of developing schemes need apply. State experience, age and salary required.—Address, 9581, The Engineer Office. 9581 A

DRAUGHTSMAN REQUIRED, One with Knowledge of Machine Tool Design and Automatic Work essential. None others need apply. Salary £4 10s. per week.—Address, stating age and experience, 9560, The Engineer Office. 9560 A

DRAUGHTSMAN REQUIRED, with Experience in all kinds of Steel Works Furnaces and Gas Producers. Must be quick, neat and accurate, and able to take out weights and quantities.—Address, stating age, experience, and salary required, 9588, The Engineer Office. 9588 A

DRAUGHTSMAN.—WANTED, Smart YOUNG MAN with experience and well up in theory.—State age, salary, and full particulars of training and experience, to THOS. PIGGOTT and CO., Ltd., Gas, Hydraulic and Constructional Engineers, Spring Hill, Birmingham. 9565 A

EXPERIENCED DRAUGHTSMAN REQUIRED, with knowledge of General Engineering Work, Steel Structural Work, or Chemical Plant Design and Lay-outs, for large factory in London.—Address, stating age, experience and salary required, 9540, The Engineer Office. 9540 A

HEATING DRAUGHTSMAN REQUIRED. Fully experienced and capable of Designing and Estimating large centralised schemes.—Apply in writing, giving details, age and salary required, to THE BRIGHTSIDE ENGINEERING CO., 17, Summerrow, Birmingham. 9580 A

INDIA.—Experienced CARRIAGE and WAGON DRAUGHTSMAN REQUIRED for Rolling Stock Department of large Engineering Works. Five years' agreement. Free passage out and home. Unmarried, 25-28 years. Salary according to capabilities.—Write, with details of experience, to Z.H. 582, c.o. Deacon's, Fenchurch-avenue, E.C. 3. 9570 A

JUNIOR DRAUGHTSMAN REQUIRED. Workshop experience and some technical training desirable, experience in Aircraft Industry an advantage, but not essential. Salary 50s. to 70s. weekly, according to qualifications.—Apply by letter, METAL PROPELLERS, Ltd., Purley Way, Croydon. 9561 A

MECHANICAL DRAUGHTSMAN REQUIRED by Engineering Firm in Midlands. Some knowledge of Building and Steel Work Construction an advantage.—Address, giving wages required, previous experience, and age, 9554, The Engineer Office. 9554 A

REQUIRED, ASSISTANT DESIGNER, Capable of carrying out complete design of new type of Aircraft under instruction of Chief Designer.—Address, 9555, The Engineer Office. 9555 A

REQUIRED AT ONCE, First-class DRAUGHTSMAN, with experience on Four-stroke and Two-stroke Solid Injection Oil Engines. Air Injection Oil Engine experience an advantage. State age and salary and when at liberty.—Address, 9563, The Engineer Office. 9563 A

REQUIRED for London Office, Detail and Proposal DRAUGHTSMEN, fully experienced in Mechanical Handling Plants.—Reply, stating age, experience and salary, to MITCHELL CONVEYOR and TRANSPORTER CO., Ltd., Atlantic House, Holborn Viaduct, E.C. 1. 9571 A

SENIOR DRAUGHTSMAN REQUIRED for Structural Steelwork; Power Station experience an advantage.—Apply by letter, stating experience, age and salary required, to BABCOCK and WILCOX, Farringdon-street, London. P4977 A

SENIOR DRAUGHTSMEN WANTED for Steam Turbine Details; also for Steam Power Station Lay-out.—Write, stating age, training, experience, salary, and date free, to CHIEF DRAUGHTSMAN, English Electric Co., Ltd., Rugby. 9564 A

SENIOR DRAUGHTSMAN WANTED for Turbine Pumps, capable of taking charge of contracts, deep well experience preferred. State age, experience, and salary.—Address, 9560, The Engineer Office. 9560 A

STRUCTURAL STEELWORK.—One or Two SENIOR DRAUGHTSMEN, with good experience of the design and detail from Architects' plan on own responsibility, including necessary site surveying.—State salary required.

Applications only by letter to CHIEF DRAUGHTSMAN, Messrs. Smith Walker, Ltd., 16, Caxton-street, S.W. 1. P4978 A

INDIA.—REQUIRED, Capable MACHINE SHOP FOREMAN, with general experience in Machining of Forgings and Castings, as well as Turret Lathe Work. Age 26-30 and single.—Write, with full particulars of experience and copies of testimonials, to Z.E. 558, care Deacon's Advertising Offices, Fenchurch-avenue, London, E.C. 3. 9584 A

## SITUATIONS WANTED

AN ENGINEER, with Long Experience in Steel Works Management and Production, and with a good connection in Glasgow and Scotland, DESIRES to REPRESENT STEEL or ENGINEERING FIRM in the Midlands, the South of England, or the Continent in Technical Matters, Inspection of Materials, or Sales of Specialities connected with General Engineering and Steel works practice.

Address, P4957, The Engineer Office. P4957 B

CIVIL ENGINEER, 26 Years of Age, A.M.I.C.E., 6 years' experience on design and construction of harbour and riverside works, REQUIRES PROGRESSIVE APPOINTMENT.—Address, P4962, The Engineer Office. P4962 B

ENGINEER (27), First Class B.O.T., Experienced all classes reciprocating engines, turbines, boilers, and D.O., SEEKS RESPONSIBLE POSITION with prospects.—Address, P4972, The Engineer Office. P4972 B

ENGINEER already Representing Important Interests SEEKS another LONDON AGENCY. Constructional or heavy engineering plant preferred. Could handle provinces if desired. Only first-class propositions considered.—Address, P4956, The Engineer Office. P4956 B

ENGINEERING WORKS MANAGER, A.M.I. Mech. E., specialist in marine engine-room auxiliaries and refrigerating machinery, DESIRES RESPONSIBLE POSITION, Management or Sales.—Address, P4959, The Engineer Office. P4959 B

## SITUATIONS WANTED (continued)

HONOURS GRADUATE in Engineering (Liverpool University) SEEKS POSITION offering interesting work with prospect of advancement. Age 25. Three years' practical experience in large electrical engineering works, including two years in testing departments. Excellent references.—Address, P4969, The Engineer Office. P4969 B

MACHINE AND PRESS SHOPS.—First-class TOOL-ROOM MECHANIC SEEKS ENGAGEMENT. D.O. exp., energetic and resourceful man with wide manufacturing experience.—NEWEY, 147, Brookhill-road, Birmingham. P4967 B

POST as MANAGER or PRODUCTION ENGINEER WANTED by qualified Engineer (M.I. Mech. E.) desiring change. Fourteen years as works manager. Expert on output at low costs. Energetic and good organiser.—Address, P4973, The Engineer Office. P4973 B

QUALIFIED ENGINEER (39), with Experience in LOW-TEMPERATURE CARBONISATION, COMBUSTION ENGINEERING, POWER-HOUSE INSTALLATIONS, PETROLEUM INDUSTRY, STRUCTURAL WORK, SEEKS RESPONSIBLE POSITION, home or abroad.—Address, P4963, The Engineer Office. P4963 B

STRUCTURAL ENGINEER. One Used to Bridges, &c., SEEKS POST, home or abroad; age 27; experience India.—Address, P4965, The Engineer Office. P4965 B

STRUCTURAL ENGINEER, Used to Bridge Work &c., SEEKS POST as INSPECTOR; age 27; varied experience steel work, home or abroad.—Address, P4966, The Engineer Office. P4966 B

WORKS MANAGER. Public School Education. Successful repetition production, expert organiser, control large staffs. SEEKS POST; can prove ability.—Address, P4980, The Engineer Office. P4980 B

20 FATHOMS DEEP. 200 FEET HIGH.—SHIP and STRUCTURAL PLATER (42), will TACKLE any PROPOSITION in Iron or Steel, from drawing-office to completion.

Last 5½ years with G.W.R. in charge of repairs and reconstruction of bridges (including reconstruction of Liskeard Viaduct and Brunel's Royal Albert Bridge). Previously on own account, diver and salvage contractor.

Address, P4958, The Engineer Office. P4958 B

DRAUGHTSMAN, Age 36, 20 Yrs.' Exp. of Railway and Road Rolling Stock, mechanical and structural engineering, DESIRES SUITABLE POSITION, at home or abroad.—Address, P4961, The Engineer Office. P4961 B

ENGINEERING DRAUGHTSMAN, with 20 Years' general and mechanical experience, SEEKS POST, London district.—Address, P4918, The Engineer Office. P4918 B

## PARTNERSHIPS

IF YOU ARE SEEKING
**A PARTNER or PARTNERSHIP**
or wish to buy or sell a
**BUSINESS or WORKS**
Write:
**WHEATLEY KIRK, PRICE & CO.,**
46, Watling Street,
London, E.C. 4.
Established over 75 years.

WANTED, ENGINEER with Foundry Experience, £2000/£3000 capital.—Address, P4970, The Engineer Office. P4970 C

ENGINEER, Having Perfected Important Invention, REQUIRES CAPITAL of £5000 to develop and market it efficiently. Limited company already formed. Full particulars to principals only.—Address, P4964, The Engineer Office. P4964 C

## EDUCATIONAL

ENGINEERS (Technical, Administrative, and Sales), DRAUGHTSMEN and TRACERS requiring positions or desiring to improve, write for particulars.—STAFFORD O'BRIEN and CO., 66, Victoria-street, S.W. 1. 9585 E

"ENGINEERING OPPORTUNITIES." This is a book you must not miss. It contains brilliant articles by Prof. A. M. LOW, our Employment Supdt., &c., shows how to pass A.M.I. Mech. E., A.M.I.C.E., A.M.I.A.E., A.M.I.E.E., Matric., C. & G., and G.P.O. Exams., and outlines over 60 home study Courses in all branches of engineering. Send for free copy to-day (state subject or Exam.). We alone guarantee "NO PASS—NO FEE."—BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, 29, Shakespeare House, Leicester-square, London. P4912 E

QUALIFIED ENGINEERS REQUIRED.—You Need not be long in your present rut. There is at least one engineering qualification for which you are eligible and when you have got it your advancement will be rapid. For one fee the T.I.G.B. will train you until you pass any of the following examinations:—

| | |
|---|---|
| Mechanical Engineering. | Electrical Engineering. |
| Automobile Engineering. | Civil Engineering. |
| Structural Engineering. | B.Sc. (Eng.) London Univ. |
| Aeronautical Engineering. | City and Guilds Certificates and Medals. |

Post this advertisement, marking the course you want, to
THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN,
(Established 1917),
78, TEMPLE BAR HOUSE, LONDON, E.C. 4.
and full information will be sent, together with the 64-page Free Book, "The Engineer's Guide to Success."

**Correspondence Courses**
OF PREPARATION FOR THE
**Examinations** of the
INST. OF CIVIL ENGINEERS,
INST. OF MECHANICAL ENGRS.,
INST. OF STRUCTURAL ENGRS.,
UNIVERSITY OF LONDON, &c.,
are personally conducted by
**Mr. Trevor W. Phillips,**
B.Sc., Honours, Engineering, London University, Assoc. M. Inst. C.E., A.M.I. Struct. E., M.R.S.I., F.R.S.A., Chartered Civil Engineer, &c.
For full particulars and advice apply to:—8-11, TRAFFORD CHAMBERS, 58, SOUTH JOHN ST., LIVERPOOL (Tel. Bank 1119). LONDON OFFICE:—45, CHANCERY LANE, W.C. 2. Ex.

**For continuation of Small Advertisements see page 4.**

**Electric railways, public utilities, water, timber, oil, industrial and mining enterprises promoted. Approved bond and stock issues placed with European bankers and brokers. Underwriting procured for corporations. Mining and other examinations and reports made by well known engineers. BYRNE & LANE, 74, Lower Leeson Street, Dublin.**

# A Seven-Day Journal

## Indian Air Mail Services.

ALTHOUGH it is proposed that the new British airships "R 100" and "R 101" should be used experimentally on a service between this country and Karachi, India, by way of an intermediate station at Ismailia, Egypt, attention is still being given to the development of an aeroplane air mail service that would link England with India, and possibly later on with Australia. An important step towards the realisation of such an aeroplane service is reported this week from Simla. It is stated that the Finance Committee of the Indian Legislative Assembly has approved of the Indian Government's proposal to call for tenders for the operation of a weekly aeroplane service between Karachi and Delhi, Delhi and Calcutta, and Calcutta and Rangoon. The companies operating the three sections would be subsidised to begin with. The ground organisation at Karachi and Calcutta is now well in hand, and it is anticipated that the Karachi–Delhi section will be ready for operation by the autumn of next year. It is proposed also to construct an aerodrome at Bombay. One of the conditions of the contract will be that the services throughout shall be operated by three-engined aircraft of an approved British type. At the present moment there is a regular aeroplane air mail service between Cairo and Baghdad, with an extension to Basra at the head of the Persian Gulf. The organisation of the section from Basra to Karachi has been delayed by political differences with the Persian Government, but it is believed that by next April a regular aeroplane service, subsidised by the British Government, will be established between Cairo and Karachi. When the service is completely established, the time for the transmission of mails between England and points in India will be reduced to less than half that now occupied in carriage by sea.

## New Sloops for the Navy.

H.M.S. "BRIDGEWATER," the first of a new class of sloops designed for the dual function of overseas service and mine-sweeping, was launched at the Hebburn yard of R. and W. Hawthorn, Leslie and Co., Ltd., on Friday of last week, September 14th. This vessel and a sister ship which is on the stocks at the same yard were authorised in the Navy Estimates for 1927, in place of four motor launches for which provision had been made in the original five-year plan of naval construction. Four further sloops are to be built under the current Estimates. When announcing this modification of the building programme, the First Lord mentioned that twenty-three sloops are now maintained in commission, nineteen of which were performing what really amounted to cruiser duty, such as patrolling the Red Sea and the Persian Gulf, and showing the flag in other parts of the world. As many of these vessels will soon reach an age at which it would not be economical to effect the repairs necessary to give them a considerable extension of life, the soundest policy is to lay down new craft, especially as a dozen sloops can be built for the price of one cruiser. The "Bridgewater" and her sister ship have been built to a displacement of 945 tons, the length overall being 250ft. Sea-keeping qualities are assured by the relatively high freeboard, long forecastle deck, and pronounced flare at the bows. With a view to service in tropical waters, the crew's quarters have been made exceptionally roomy and well ventilated. Two 4in. guns and several machine guns constitute the armament. Propulsion will be effected by twin-screw turbine machinery of the Parsons impulse-reaction type, with single reduction gearing, designed for 2000 S.H.P. There are two boilers of the three-drum pattern, burning oil, and delivering steam at a maximum pressure of 250 lb.

## The German Airship LZ 127.

THE German airship "LZ 127" or "Graf Zeppelin," as she has now been named, is apparently at last ready for her trial flights. Early on Saturday morning of last week crowds of spectators assembled in the neighbourhood of the Friedrichshafen works to witness the vessel's first appearance. They were, however, disappointed, for she remained in her shed. Various explanations were advanced for her failure to appear as promised. One explanation had it that the necessary permit for a flight had not arrived from the Ministry of Communications. Another was to the effect that the weather did not provide the perfectly still conditions required to withdraw the vessel from her shed with safety. A third suggested that difficulties had been encountered in connection with the production of the fuel gas on which the engines are to run instead of on petrol or heavy oil. On Tuesday of this week doubts were set at rest. The vessel was safely brought out of her shed and was given a successful first flight of two hours' duration. The fuel used was petrol, the authorities, so it is reported, having prohibited the use of the "blaugas," of which so much has been heard. The first important flight which the airship will undertake will probably be a propaganda trip to America, but it is questionable whether that trip will be made this year. It is stated that for the Transatlantic voyage from 25,000 to 30,000 cubic metres of the fuel gas would be required, but that the production of this gas is proceeding very slowly and that for the trial flights the five 530 horse-power Maybach engines will be supplied with petrol. The vessel has a length of 235 m. and a maximum diameter of 30·5 m. She fits the shed within which she has been erected with only a few inches to spare at the top and the sides. Her gas capacity is 3½ million cubic feet, so that she will be very much smaller than the 5,000,000 cubic foot airships now being built in this country. She will carry a crew of twenty-six, twenty passengers, and 15 tons of freight, as compared with a crew of fifty and a hundred passengers in the case of the British vessels.

## The Embankment Subway Fire.

THE work of restoring the London telephone service, which was interrupted as the result of the fire in the Embankment subway on Saturday, September 8th, is steadily proceeding, but a definite date for the complete restoration of the service of every circuit cannot at present be given. The subway represents an important section in the network of arterial underground routes carrying telephone cables for the service of Central London. It accommodates about fifty large lead-sheathed cables, some of which contain as many as 800 telephone circuits. The fire entirely destroyed every cable passing along the subway for a distance of about 60 yards, and the work of restoration involves the reinstatement of the identity of many thousands of circuits on each side of the portion of the subway affected. Needless to say, this is an intricate and laborious task, which will take some little time to accomplish. On more than 1400 telegraph and trunk telephone circuits and junction circuits between exchanges it was possible to restore communication by utilising other routes containing spare circuits which were available for connection points in the vicinity. Before the repair work could proceed in the subway itself the damaged cables had to be cut away and cleared out and the subway reconditioned as far as practicable. The number of men employed on the job is the maximum that the working space will permit, and the work is proceeding day and night. At the time of writing five cables have been restored *in situ*, including two trunk telephone and telegraph cables, an important junction cable, and police and fire cables. Work on those carrying subscribers' circuits is proceeding steadily.

## The British Steel Trade.

THE plight of the British steel trade was discussed by Mr. C. E. Siddall at the annual meeting last week of the Sheffield Forge and Rolling Mills Company, Ltd. The company's balance sheet disclosed a loss on the year's working of £9392, to which a deficiency of £53,487 brought forward from last year must be added. The chief causes contributing to the loss, Mr. Siddall stated, were the very high cost of production, the shortage of work, increasing competition, and the alarming growth in the "oddment" nature of the orders received by the company. Last year, he said, it cost £125,000 to produce 28,000 tons of steel. Before the war it cost £76,000 to produce 41,000 tons. Local rates and insurance last year amounted to £6820, compared with £1600 before the war. Mr. Albert Senior, who also addressed the meeting, said that straightforward orders were becoming fewer and fewer, and "oddment" orders more and more frequent. We were, in fact, becoming a nation of jobbers. A test made last year at the Sheffield Forge showed that the cost of producing oddments was three and a-half times as great as the cost of fulfilling bulk orders. We must not, however, leave our readers with the impression that the meeting was one of unrelieved pessimism. Mr. Siddall himself shed more than a ray of comfort when he reminded the shareholders that while the firm's total losses since 1922 had been £121,165, such losses were nothing new. They had experienced similar losses in the 'eighties, but from them they had emerged successfully and for twenty years afterwards had maintained an average dividend of 12 per cent. free of income tax. He was also consolatory in his statement that the company, in spite of the onslaught on its finances, was still in a perfectly sound condition.

## The Marine Uses of Electricity.

IN a paper which was read before a special meeting of the Institute of Marine Engineers, which was held at the Machine Tool Exhibition at Olympia on Friday last, September 14th, Mr. A. C. Hardy, of *Motorship*, New York, dealt with the increasing use of electricity aboard ship, and indicated that an important industrial development might follow the introduction of electric propulsion. In order to show the increasing size of the auxiliary machinery some interesting figures were quoted, from which it was seen that the proportion of auxiliary power to main propelling power varied in ships of recent design from 10 to 26 per cent. In some instances, notably those of large motor ships, the auxiliary engine-room takes up more space than that necessary for the main engines. Mr. Hardy suggests that in such cases electrical propulsion certainly seems to be justified. It makes for high economy where big fluctuations in total power developed are necessary, and gives extreme flexibility. Typical examples of modern electrically-propelled ships were given, and the application of the system to large liners, coastal and river vessels and tugs and dredgers was described and illustrated. Both the Diesel electric and the turbo-electric systems may, in the author's opinion, have special fields of application, but it is suggested that for the larger powers turbo-electric propulsion may prove more suitable for large liners. The subject of the paper was suggested to the author after reading another paper on the "Shipowner and the Motorship," before the Swedish Society of Naval Architects in Stockholm in May last, when the discussion turned almost entirely on the subject of the electrical propulsion of ships.

## British Sailing Ship Returns.

THE newly issued report of the British Sailing Ship Owners' Association quotes Lloyd's Register records to show that during the year ended June 30th, 1928, there was a decrease in the world's sailing ship tonnage, excluding vessels with auxiliary engines, of 130,362 gross tons, which decrease was, however, less than that of 186,825 gross tons for the preceding year. The total world tonnage of sailing ships of 100 tons gross and over, excluding those fitted with auxiliary power, was on June 30th, 1928, 1,795,246 tons. If, however, barges and similar craft, of which only 18,400 tons are owned in Great Britain and Ireland, be excluded, the total is then reduced to about 1,029,000 tons. The sailing ships fitted with steam and motor auxiliary engines showed a slight increase, there being 1239 vessels, with a total of 313,532 gross tons, compared with 1198 vessels, aggregating 316,381 tons, in the preceding year. The returns published by the Registrar-General of Shipping and Seamen show that a greater number of sailing vessels were removed from the United Kingdom Register than were added to it. During the period July, 1927, to June, 1928, 131 sailing vessels of 17,859 gross tons were added, including 47 vessels of 5132 tons built during the year, while 315 sailing ships, of 35,891 gross tons, were removed from the Register, of which 112, representing a gross tonnage of 12,620, were broken up.

## H.M.S. Nelson in the Tyne.

ON Friday last, September 14th, the Tyne-built battleship, H.M.S. "Nelson," returned to the river of her birth to receive from the inhabitants of Newcastle-on-Tyne and district, the commemorative gift of a suitably inscribed silver bell. The "Nelson" was escorted up the river by tugs and she moored by Tyne Dock, near to the edge of Yarrow Slake. The presentation was made by the Lord Mayor and Sheriff of Newcastle at the Town Hall on Saturday morning, when Admiral Sir Hubert Brand, K.C.B., the Commander-in-chief of the Atlantic Fleet, Captain Meyrick, C.B., and other officers, as well as men from the "Nelson," were present. The bell was supplied by Messrs. Reid and Son, silversmiths, of Newcastle, and its casting and machining were entrusted to J. Stone and Co., Ltd., of Deptford. It has a height of 19in., with a greatest diameter of 24in., and the clapper is 3in. in diameter. Over 7393 oz. troy of silver were melted for casting purposes, and new graphite pots were used for melting the metal. By using special sulphur-free coke, the loss of metal was only 61 oz. troy, or less than 1 per cent. The bell was cast crown upwards and special precautions were taken in the trimming, turning, filing, and burnishing operations in order to prevent any waste of metal. The finished weight of the bell was 1 cwt. 2 qr. 20 lb. 11 oz. avoirdupois, which is the largest silver bell yet made. After the presentation, the bell was carried on a gun-carriage to the quayside and then conveyed to the battleship at Yarrow Slake. The "Nelson" left the Tyne early on Tuesday morning.

## British Colliery Managers in Germany.

GREAT success has attended the visit, during the present week, of about 100 British colliery managers to the Ruhr district of Germany. The delegates have been received by Messrs. Krupps, at Essen, and have had an opportunity of viewing some of the more important collieries and coke oven plants and steelworks in the Essen and Bochum districts. The Krupps mines include eleven shafts, which penetrate no less than fifty different seams of coal. Special interest was taken in the methods employed for packing of the waste, in order to comply with the regulation that all coal extracted must be replaced with stone. Visits were also made to the Harpen group of mines and at all centres excellent hospitality was given. In the speeches at the various social functions reference was made to the value of interchange of ideas and inventions between British and German mining engineers. The party also visited the Gutehoffnungshütte steel works and mines at Oberhausen, where some interesting processes were seen in operation. At a dinner given to the delegates in Oberhausen, the suggestion was made that both Britain and Germany were now exporting coal at prices below the cost of its production, and it was stated that the German coal owners are ready to co-operate with British coal owners to remedy the present position. Considerable interest has been taken during the visit in the various welfare schemes which have been set up and are worked both by the owners and the municipal authorities. This is the first time that the National Association of Colliery Managers has held a foreign meeting.

## Machine Tool Exhibition, Olympia.

No. III.*

BEFORE going on with our description of the machinery exhibits at Olympia it seems appropriate and topical to make some reference to high-speed cutting tools.

SAMUEL OSBORN AND CO., LTD.

It is obviously difficult with the limitations imposed by an exhibition to test the capabilities of a tool steel in a scientific manner, but we were, nevertheless, gratified by the pains taken by Samuel Osborn and Co., Ltd., of Sheffield, in demonstrating the cutting capacity of their new "S.O.B.V." tool steel. This company had a billet of 30-ton mild steel in a Lang lathe, and at our request started a cut with a newly ground tool on a diameter of 8in. The cut was $\frac{1}{16}$in. deep and the feed $\frac{1}{16}$in. per turn. The peripheral speed of the job at the top of the cut was 180ft. per minute, while the motor driving the lathe was absorbing about 25 horse-power. The lathe was run under these conditions and without any lubricant being supplied to the tool until the cut had extended for a distance of slightly over 8in. along the billet. After that run we took an impression of the cutting edge of the tool and found, with the exception of a small pimple of added material, which had obviously come off the work, that that part of the cutting edge which had been at work was indistinguishable from the part actually cutting, and it was plain that the cut could have been continued at this rate for a much longer period before the tool ceased to make a clean cut. The steel of which this tool was made is amenable to the same treatment as any ordinary modern high-speed steel and is not so costly that it may not be used for the whole body of the tool, instead of being used for tipping a shank. Another test of this steel which we witnessed was the drilling of a $\frac{3}{4}$in. hole through 2in. of cast iron in $2\frac{3}{4}$ seconds. The drill was running at a speed of 715 revolutions per minute and was absorbing some 12 horse-power at the spindle. Such a performance is not, of course, one which would be aimed at in ordinary production work, but is a good demonstration of the ability of this new steel to stand up to the high temperatures inseparable from rapid machining, for, although the lips of the drill had become slightly blued, the edge was as keen and hard as at the start of the test.

DRUMMOND BROS., LTD.

We have already mentioned the tendency which appears to have developed for the employment of hydraulic means, in the place of mechanical gearing, for the operation of the feeding motions on machine tools. This policy is well exemplified on the stand of Drummond Bros., Ltd., of Guildford, where there are several lathes with hardly a hand wheel for their manipulation. Two of these machines are illustrated in Figs. 41, 42 and 43. There is also another machine on the stand without the hydraulic features, but which, nevertheless, embodies the broad principle underlying the design of the others. This principle is the employment of a number of separate tools, having a sliding movement, rather than the use of large "forming" tools for the production of complicated turned parts. In the development of this idea it was found that the effort required for returning a tool slide after it had effected a cut to the starting point again was so great that it occupied a considerable proportion of the total time on any one operation. This discovery led towards the adoption of the hydraulic operation of the tool slide and now as will be gathered from Fig. 41, the whole of the manipulative operations of the machine are carried out hydraulically.

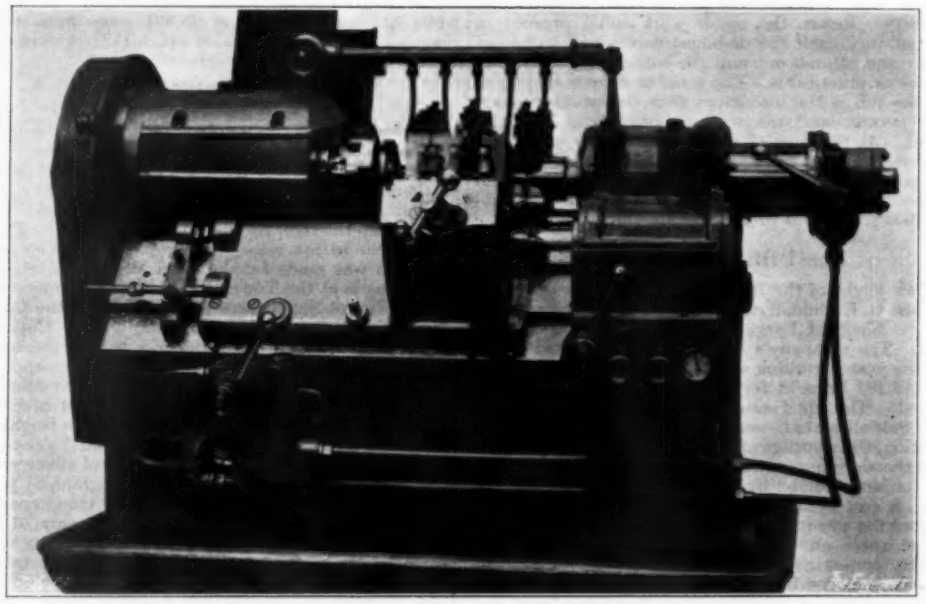


FIG. 41—HYDRAULIC MULTIPLE-TOOL LATHE—DRUMMOND

The machine illustrated in Fig. 41 is capable of accommodating pieces of work up to 6in. in diameter by 12in. long and has two tool slides—a facing slide in the front and a cross slide at the back. The slide is operated by a hydraulic ram which is supplied with oil under pressure by a constantly running gear pump, which can be seen towards the front of the lathe bed. This pump supplies more oil than is necessary to work all the control mechanism at full speed and the balance of the oil is spilled back through a spring-loaded by-pass. The rate of supply to the slide-operating ram, and, consequently, the rate of feed, is determined by a needle valve, the handle of which is conveniently placed for the operator. Two of these handles can be seen in Fig. 41 immediately to the left of the pressure gauge below the tailstock. By these means it is possible to regulate the rate of feed from the merest creep up to full speed without any appreciable manual effort. There is also, beyond the speed control handles, a lever by means of which the direction of circulation of the oil is reversed to return the tool slide to the starting position. The valve which is operated by this lever gives a full-bore passage for the oil, regardless of the adjustment of the feed, so that the return is effected as quickly as is possible.

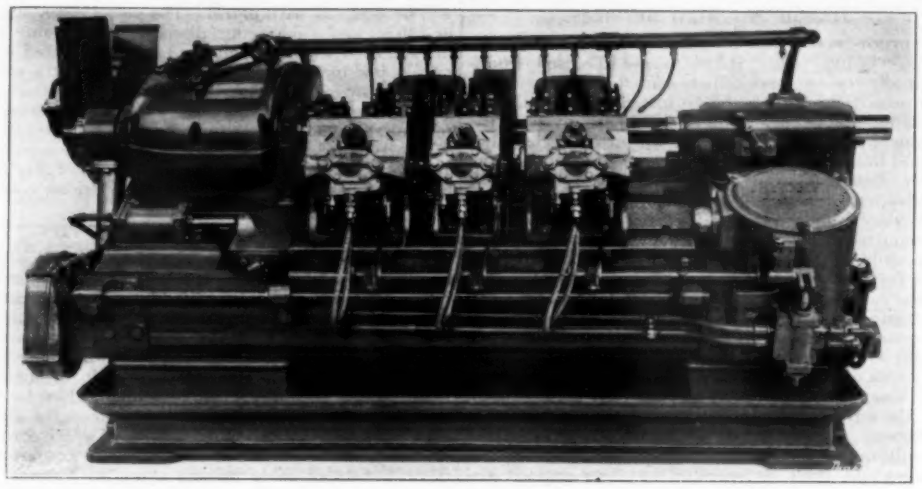


FIG. 42—LARGE HYDRAULIC MULTIPLE-TOOL LATHE—DRUMMOND

It will be observed that the back centre of the lathe also is operated hydraulically, and in this connection we had an interesting conversation with Mr. Drummond. It was, in general effect, that while one of these new machines had reduced the time of production for a piece of work from about 15 minutes to $1\frac{1}{2}$ minutes, the time occupied in screwing the back centre backward and forward, in setting a new blank, was at least 25 seconds. That is to say, the whole process had become so far speeded up that any possible gain on 25 seconds per piece was worth consideration. The hydraulic tailstock has effected a very material gain in this direction. It comprises a large barrel, which slides in a bracket cast in one piece with the bed, that can be racked in or out to suit the length of the job in hand. Within this barrel there is the hydraulic ram for pushing forward the back centre itself. In action a lever, seen on the right in Fig. 41, is thrown over to admit oil under pressure to the ram and to push the centre forward against the work. The reaction of the ram then comes against what might be described as a collet chuck and grips the centre spindle quite definitely. It will be noticed that the aprons of the slides protect the slides well from falling swarf, and the absence of feed screws, naturally, tends towards the minimising of trouble in this direction.

The larger machine shown in Figs. 42 and 43 embodies the same general principles as to hydraulic operation, but has several special features, as it is intended to be adaptable for work of widely varying lengths. It will be seen that the cutting tools are carried in two groups of slides—three in the front and three behind. Each of these slides is readily demountable, so that the machine can be quickly adapted for handling short work, and there is accommodation

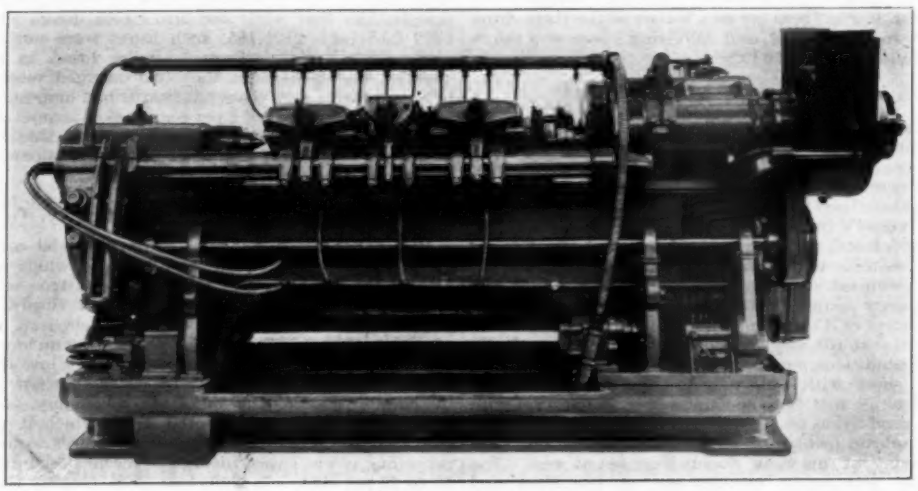


FIG. 43—LARGE HYDRAULIC MULTIPLE-TOOL LATHE—DRUMMOND

* No. II. appeared September 14th.

between the slides for steady rests to support long slender pieces.

The tools are moved to and fro on the front slides entirely by hydraulic means. They approach the work quickly and then, at any predetermined position, slow up to the cutting speed, each slide having its own ram for this purpose. There is another ram for giving the longitudinal travel, which can be seen on the left in Fig. 42. The back slides—see Fig. 43—are fed into their work by racks and segmental pinions on a lay shaft running along the back of the machine. This shaft is oscillated by a lever and cam from the gear-box in the front of the tailstock and pushes the slides forward against the resistance of hydraulic rams. In this way the cutting feed is obtained and a quick return is effected by the hydraulic pressure as soon as the forward impulse of the cam is released.

This machine, with which we hope to deal more extensively at some future date, will accommodate pieces of work up to 2ft. 6in. long and may be fitted up with as many as forty-four tools all cutting simultaneously.

J. PARKINSON AND SON.

On the stand of J. Parkinson and Son, Shipley, there are several milling machines and a gear cutter. Among the former the most novel is that illustrated in Fig. 44. It has table movements of 40in. by 12in. by 20in.; sixteen spindle speeds, ranging from 14–340 revolutions per minute; and sixteen rates

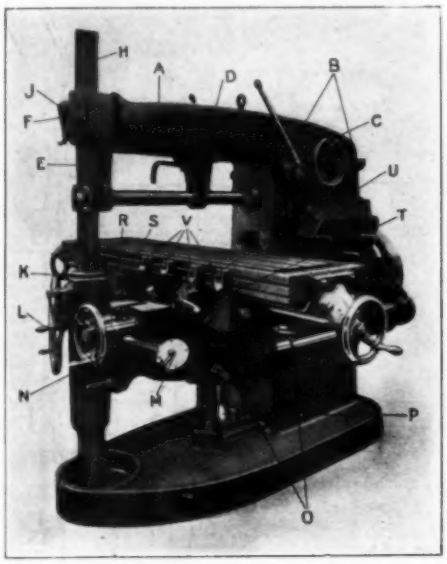



FIG. 44—MILLING MACHINE—PARKINSON

of feed ranging from ¼in. to 14¼in. per minute to the longitudinal, cross and vertical movements of the table. In addition, there is a power traverse at the rate of 25in. per minute to the cross and vertical movements, and a rapid power traverse, to the longitudinal movement only, at 120in. per minute, at which rate the table may be run towards the cutter until the cutting position is reached, accelerated between cuts or returned to the starting position on the completion of a cut. The table may also be equipped, as shown in the illustration, with trip mechanism, which automatically controls the changes of rate and direction of traverse. The table is traversed by the nut rotating around the stationary screw, the nut being driven from the splined shaft shown below the table. The nut may be de-clutched to enable the shaft to rotate without traversing the table for driving a rotary table or other accessories by change gears from the end of the shaft.

On reference to the illustration it will be seen that the overarm A fits in dovetail ways across the top of the column, and is clamped firmly by nuts B. When the nuts are released, it may be moved forward or backward by the hand wheel C rotating a pinion which engages a rack cut on the underside of the overarm. As many arbor supports as are required may be clamped to the dovetail slide way on the underside of the overarm, as shown at D, and the end of the overarm is formed to receive the outermost support E for arbors, which has a slight longitudinal adjustment by the screw F, the reason for which will be made clear later.

Passing through and fitting in bosses on the overarm and on the arbor support, there is a vertically sliding bar H raised and lowered by the crank J through a rack and pinion. The lower end of the bar H fits over a projection which extends upwards from the front of the knee bracket or slide at K, to which it is secured by a screw actuated by the handle L, so that when the screw is tightened and the bar H clamped to the overarm and arbor support, H becomes a brace by which the overarm is securely braced at its outer end to the knee, and consequently supports the table, whilst at its other end it is clamped in the main frame or column of the machine. Thus, as the stresses caused by cutting come between these two points, they are effectively resisted, and the machine is enabled to take heavy cuts without deflection or vibration.

When arbors or cutters have to be changed, the screw and bolts which clamp the brace H are unscrewed, and the brace slid upwards by the hand wheel J until it is clear of the arbor support E (being held in that position by a ratchet pawl). The arbor support bracket or brackets may then be slid off the overarm, leaving a clear course for removing or replacing cutters and arbors. When replacing the end arbor support, it is necessary to align the holes through which the brace H passes, which is easily done by means of the adjusting screw F. The rigidity of the machine is still further ensured by a circular guide from the base to the knee. As may be seen, this fits in a long boss at the front of the knee, co-axial—though this is not essential—with the vertically sliding brace H.

The details of feed control are as follows:—M is the feed change shaft, each quarter revolution of which changes to another rate of feed, so that four revolutions only are required to obtain the full range of sixteen rates. The correct position for each rate is shown by a graduated dial, and the holes in which the plunger in the crank handle engage. N is the lever by which all feeds may be started, stopped or reversed. O, the selector levers, one in front and one behind the table, by which the feed is selected, according to whether longitudinal, cross or vertical, is required. P operates the cross and vertical traverses at 25in. per minute. R is the usual automatic trip to the longitudinal traverse. S is a knob, half a turn of which de-clutches the table nut, so that the splined shaft under the table may run without traversing the table, for purposes referred to above. T is the lever which operates the quick traverse to the table at 120in. per minute. This traverse is independent of the spindle, and may therefore be used when the spindle is at rest. At U are the plungers, actuated by the reversible dogs or trips V which automatically cause the rate of feed to be changed or reversed, so that cycles of table movements may be repeated automatically, without recourse to hand control. The table movements of the machine are 40in. longitudinal by 12in. cross, and the greatest distance from the table to the spindle centre is 20in.

A plain milling machine shown on this stand has been specially designed with a view to repetition work or for "long runs" of the same job, and it has therefore been possible to simplify the construction in some respects, and to embody other features which are not common in the regular type of plain milling machines, whilst making the machine generally more robust for the heavier duty which such work demands. The table movements are 32in. by 5in. by 12in. The driving pulleys—tight and loose—are arranged at the side of the machine which may be driven directly from the line shaft or by a motor mounted on the top of the column as is the case with the machine exhibited. The final drive to the spindle is through double helical gears. The machine has twin or double overarms, and the table has a power feed in the longitudinal direction only. The direction of the rate of traverse either at the cutting feed or at the quick traverse in both directions is controlled by a single lever by which also the traverse is started and stopped. The power traverse of the table may be operated with the spindle at rest, so that the table may be run back after a cut has been taken without the cutter revolving and marking the work. All the movements are controlled from the front of the machine without the operator having to change his position—an important feature when repetition work is being done. There is a tubular stay from the base to the front of the knee, which gives additional support and takes vertical and lateral stresses. The cutter coolant is returned from the table through the tubular support to the tank in the base.

The surface milling machine represented in Fig. 45 obviously is not a general purpose machine, but though its sphere may be somewhat limited, there is a definite field of usefulness for it, and on the classes of work for which it is adapted, the results will compare very favourably with those obtained on more expensive machines of other types.

The main frame is in one casting on which fits the saddle supporting the table. The height of both spindle and table are fixed, without vertical adjustment. In the machine shown, the centre of spindle is 10in. above the surface of the table, but this dimension may, of course, be made more or less in machines built to special order. The driving pulleys, tight and loose, are at the left hand-side of the column when viewed from the front, so that the machine may be driven from a line shaft, or if for motor drive, the motor is mounted on the top of the column to drive by belt (or chain) to the main shaft. When arranged for a belt drive, the machine is started and stopped by lever, which operates the belt striking gear, while another lever is used to de-clutch the drive to the spindle, so that the spindle may be stopped if desired while the table is returned at quick speed past the cutter, using the power traverse. The lever has a safety catch to prevent the clutch being unintentionally engaged.

The speed of the spindle on a machine of this kind seldom, if ever, requires changing, unless cutters of different diameters are to be used, or for cutting different classes of material; but provision is made for altering the speed by pick off change gears, or if

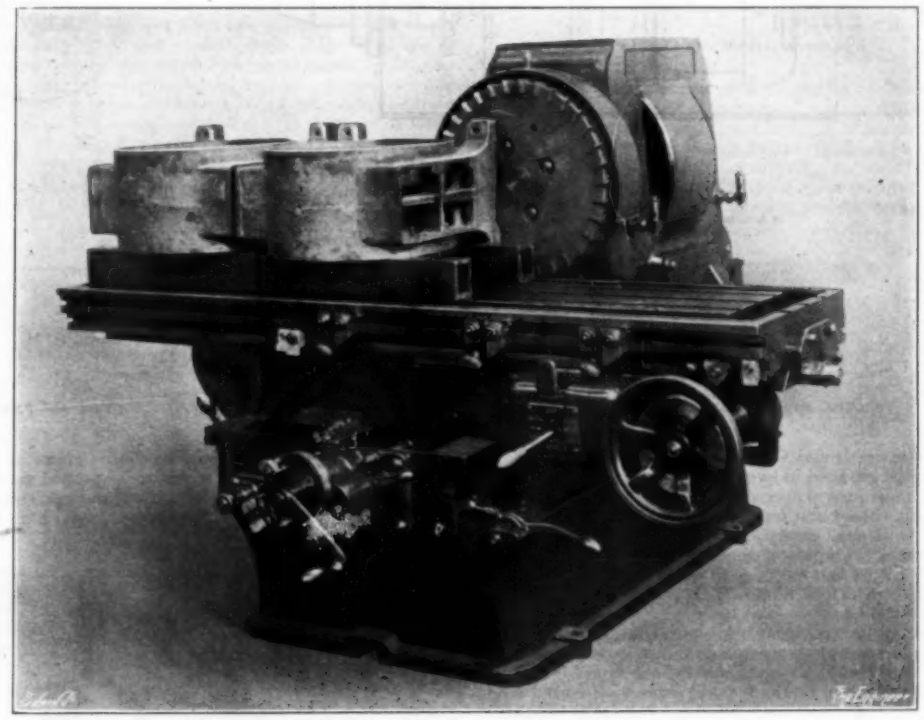


FIG. 45—SURFACE MILLING MACHINE—PARKINSON

frequent changes are required, a change speed gear-box with lever change may be supplied. The final drive to the spindle is through double-helical gears. The spindle has a conical bearing, 7in. diameter, and carries the face milling cutter spigoted, clutched and bolted direct to the flange on the spindle.

The face milling cutter shown with inserted teeth is 24in. diameter, and is suitable for milling faces up to 22in. across and 36in. long, on a machine having 48in. traverse. The table is supported by a saddle 4ft. 8in. long. The cross traverse is 6in. and the approximate weight of the machine 72 cwt.

Referring more fully to the table movements, a hand wheel is used for traversing the table when setting up and adjusting the trips, but when engaged on repetition work, after the trips have been correctly set, all further movements of the table are operated by the table traverse control lever. Moving this lever to the left causes the table to traverse towards the left, and moving it to the right causes the table to move in that direction. Pressing the lever down gives the slow traverse or the cutting feed, and lifting it gives the quick traverse at a constant speed of approximately 100in. per minute. In order to stop any feed or traverse, the lever is moved to the centre of its horizontal movement, regardless of its vertical

position. With this construction there is no "gate," and either feed or traverse can be instantly and directly engaged. The machine shown also has a trip mechanism which automatically controls the changes of rate and direction of traverse. By this means the table may be made to traverse quickly to advance the "work" almost up to the cutter, when the slow or cutting feed is automatically engaged, and at the end of the cut the table is traversed back at the quick rate to the starting point. The movement of the table will then stop, or if it is desired to take a roughing cut followed by a finishing cut, the trips may be set so that instead of stopping at the end of the return stroke, the travel of the table is again reversed, and these movements are repeated before coming to rest, the saddle carrying the table being moved automatically towards the cutter, to provide for the finishing cut, before the second cycle of the table movements. This action is effected by a trip or dog on the rear side of the table acting on a connection to the cross traverse screw, excessive movement of which is prevented by stops and a slipping clutch. A crank handle is used to rotate the cross feed screw by hand, and a lever is used to return the saddle to the position for the first or roughing cut on a fresh piece of "work." Duplicating the trips on the table will provide for the quick and slow traverses being engaged alternately, so that gaps between seatings may be quickly passed over and maximum production obtained with minimum attendance.

### A. Butterworth and Co.

The exhibit of automatic machine tools by A. Butterworth and Co., of Ainsworth-street, Rochdale, may be grouped in two main classes, the first comprising machines arranged for producing parts from bar stock, the second for chucking work, such as machining castings, stampings, forgings, steel blanks, &c. Typical examples of these two classes are illustrated in Figs. 63 and 64, page 318.

The principal aim in either class is to produce a machine which by the simplicity of design facilitates setting up, whilst at the same time it is capable of turning out work at the maximum rate of production at which the material can be machined. The idea generally has been to enable the production economically of small quantities of work that previously could only be dealt with on capstan lathes.

As regards the time required for setting up, it is claimed that it only takes about 15 minutes more than in the case of ordinary capstan or turret lathes to get the machining operations automatically performed, and that this extra time is speedily regained when the machine is in operation. Also that quantities as low as twenty-five pieces can be machined economically on the chucking automatic lathes, and as low as one gross lots on the bar automatic capstan lathes.

The construction of the bar automatic machines embodies some interesting features. The spindles are made from high grade steel forgings, and the $\frac{3}{8}$in., $\frac{1}{2}$in., $\frac{3}{4}$in., $\frac{7}{8}$in., and 1in. spindles run on ball bearings, permitting high speeds to be attained. In the smaller machines the spindle speed reaches 5000 revolutions per minute. There are two cross slides, which can be operated independently or simultaneously. Hexagon turrets are fitted as a standard practice, but should the work be comparatively simple, and only three turret stations required, the machine can be set up for producing two parts for one cycle of the turret. The feed is obtained through friction discs, and a planetary motion which enables any feed to be obtained according to the size or quality of the work.

In the automatic turret lathes the chuck has false jaws enabling special top jaws to be made to suit work of an irregular shape. This arrangement allows the easy chucking of any piece within the capacity of the machine, irrespective of size. A large range of speeds and feeds is obtainable, and an advantage not found on all other machines lies in the fact that there are definite locating positions for the different speeds and feeds for operation on the several turret faces. To obtain a desired speed or feed, all that the operator has to do is to put a numbered tripping dog into the required position, and the desired speed or feed is then automatically selected on the working turret face when the machine is in motion. There is an arrangement by which the machine is stopped on the completion of each cycle of the turret, and two steady arms are provided, as will be seen from Fig. 48, so that all the turret tools are piloted for the full length and heavy cuts can be taken with accuracy.

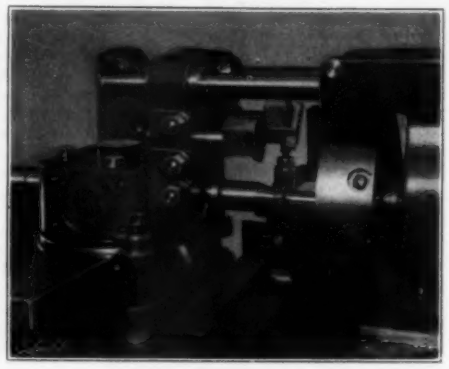


FIG. 48—STEADY ARMS—BUTTERWORTH

The bar automatic lathes are constructed to take stock from $\frac{3}{8}$in. up to 5in. diameter, and the chucking automatics will swing work up to 16in. diameter over the cross slide.

Fig. 46 shows the headstock of a $\frac{3}{8}$in. to $\frac{7}{8}$in. automatic screw machine, the construction of which enables any wear that might take place in the ball bearings to be taken up by an adjustment as fine as one-half of one-thousandth of an inch. It will be noticed that the ball bearings at the front end are of the auto-dual type, and that the two driving pulleys are fitted with ball and roller bearings. A detail of the adjustment collar is also shown. Fig. 47 shows the feed bracket of a 1$\frac{1}{4}$in. bar lathe.

### G. Richards and Co., Ltd.

On the stand of George Richards and Co., Ltd., Broadheath, near Manchester, there are a number of boring machines of both the vertical and horizontal types, and among them one of the most interesting is that shown in Fig. 49.

An innovation in this machine is the provision of a telescopic apron which prevents chippings from gaining access to the slide faces and feed screws. This apron is built up with a series of steel plates ground to a knife edge and locked, one to another, by studs sliding in grooves, so that as the table travels along the bed the several leaves are extended or packed together to form a complete cover for the bed. As the arrangement is exhibited, the slots for the studs present an opening for the passage of swarf, but as it is outside the width of the bed, it is of little account. It is, however, we believe, the intention of the firm to make dovetail grooves, from below, in the plates instead of through slots, and to use correspondingly shaped studs, so that there will be a completely flat face on the top and no opportunity for the lodgment or passage of chips.

A noteworthy feature about these machines is the interconnection between the headstock and the back steady bearing, so that the two rise and fall in unison. The movement is obtained from the gear box, and is transmitted from the vertical screw in the headstock to that in the steady by a lay shaft. There are, however, scales with verniers and magnifying glasses at either end for checking the true alignment of the bearings. In this connection it appears to us that unusual precautions are taken by these makers to ensure the accuracy of the positioning of the various parts of the machine. They are tested, for instance,

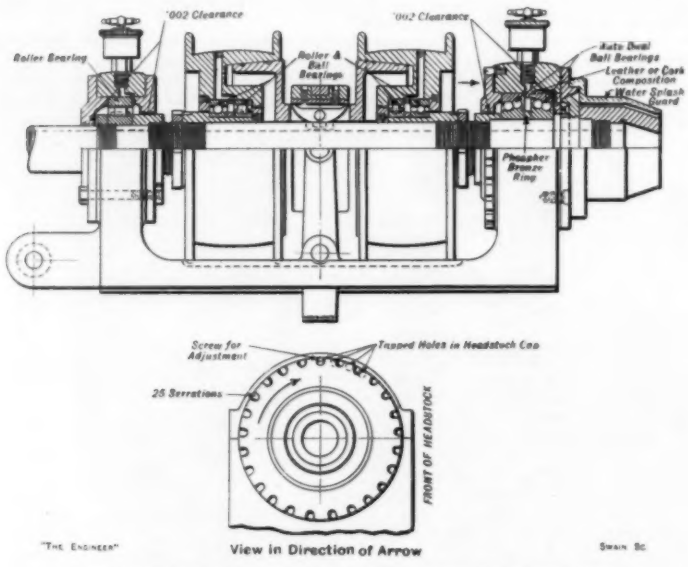



FIG. 46—HEADSTOCK OF SCREW MACHINE—BUTTERWORTH

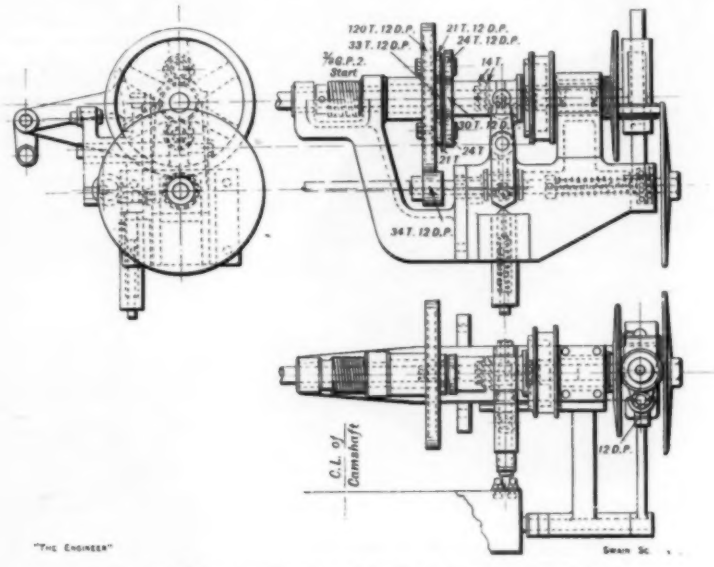



FIG. 47—FEED BRACKET OF BAR LATHE—BUTTERWORTH

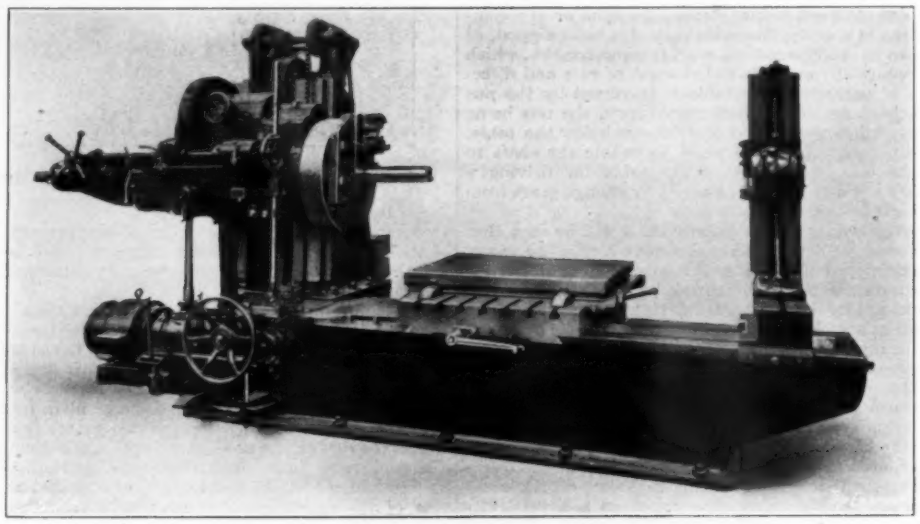


FIG. 49—BORING MACHINE—RICHARDS

by boring half way through a casting and then rotating the table, so that the two bores meet at the middle. In a sample of this class which we inspected the meeting of the two bores could not be felt with the finger, and the work was, obviously, just as it had left the machine. The location of the table angularly is effected by a long wedge which takes its bearings at the extreme edges of the table, so that the utmost support and accuracy are provided. The control arrangements on this machine are placed so as to be exceptionally convenient for the operator. It is made in several sizes for boring spindles of from 2½in. up to 6in. in diameter, and with tables up to 11ft. by 5ft. On the same stand there are other, slightly smaller, horizontal boring mills and several mills of the vertical type. One of these has duplex chucks, while the latest design of single head machine is noteworthy on account of the reduction in headroom which it requires, while all the gearing is well protected and compact.

WILLIAM ASQUITH, LTD.

On the stand of William Asquith, Ltd., Halifax, there are many drilling machines, some of which

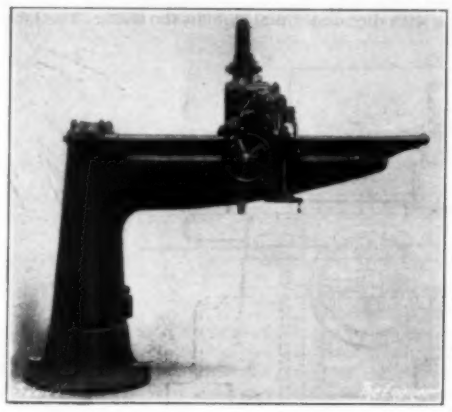


FIG. 50—GIRDER DRILL—ASQUITH

we illustrate in Figs. 50–53, together with some other appliances connected with drilling.

Of the drilling machines, that shown in Fig. 50 is intended for such work as drilling structural members, and is noteworthy on account of the fact that the feed is automatic when the drill reaches the work. As in the case of the type of drill for general duty, all the controls can be operated without fatigue and without the attendant changing his position. Generally the electric cables for supplying the motor are led direct to the saddle from a convenient position overhead, but if desired they may be let into the base of the column, which is then fitted with collector gear and the arm revolves about the column without twisting the cable. The motor itself is a 5 brake horse-power standard horizontal spindle type, mounted directly on the saddle or spindle slide. This arrangement naturally eliminates shafts and gears which have previously been necessary, and makes for greater efficiency, as practically the whole of the power is transferred direct to the spindle. The method of mounting the motor and control gear, which is shown in Fig. 53, enables various standard sizes of motors to be accommodated.

The drilling spindle is six-splined and is carried in a strong sleeve or spindle barrel by which it is supported in all positions. It is suitably balanced. A quick vertical adjustment is obtained by a hand wheel centrally located at the front of the saddle and so arranged that when the drill comes into contact with the work to be drilled a further slight movement of the hand wheel puts the power feed into operation. Reverse movement of the same hand wheel first disengages the power feed and then withdraws the spindle. The main drive to the spindle is through a heat-treated steel worm and phosphor-bronze worm wheel which run continuously in an oil bath. The spindle end is bored to Morse standard taper. The surfaces of the radial arm and the column which support the weight and thrust of the swinging parts are ground true. These machines are made in six sizes with radii from 4ft. up to 9ft. The diameter of the spindle at the driving part is 1¾in. in each case.

The machine shown in Fig. 51 is one of this firm's standard vertical drills, but possesses a novel feature, in that the table is supported on roller bearings. The table is moved in two directions by the hand wheels shown, the shafts of which carry sprocket wheels operating roller chains. The rollers of the chains form roller bearings for the slides, which move with astonishing ease, yet both are securely bound simultaneously by lifting a small lever. The drill has an outreach such that work 36in. in diameter by 2ft. 9in. high can be accommodated on the compound table, while there is an additional 2ft. of height to the baseplate. The spindle is provided with eighteen different rates of speed from 405 revolutions per minute down to 27 revolutions per minute and with four rates of feed.

The most novel machine on this stand is that shown in Fig. 52, which has a radius of 5ft. In this case

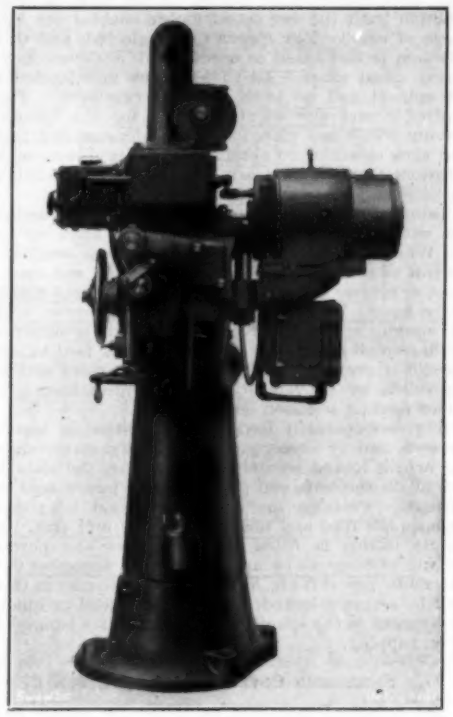


FIG. 53—GIRDER DRILL—ASQUITH

ing motion is released the arm is remarkably free and easy to manipulate. The arm is machined on one side face and on the top face to receive the slide. The elevating and lowering motion is driven by a separate reversing motor, the controller for which is built into the drill slide and arranged so that the arm is lowered at twice the elevating speed. This controller cannot be moved into the running position unless the locking devices have first been disengaged. Safety trips are provided at the upper and lower limits of traverse and a safety nut of special design is incorporated to prevent the arm falling in the unlikely event of the threads wearing out. The spindle slide is provided with four adjustable ball bearing rollers arranged

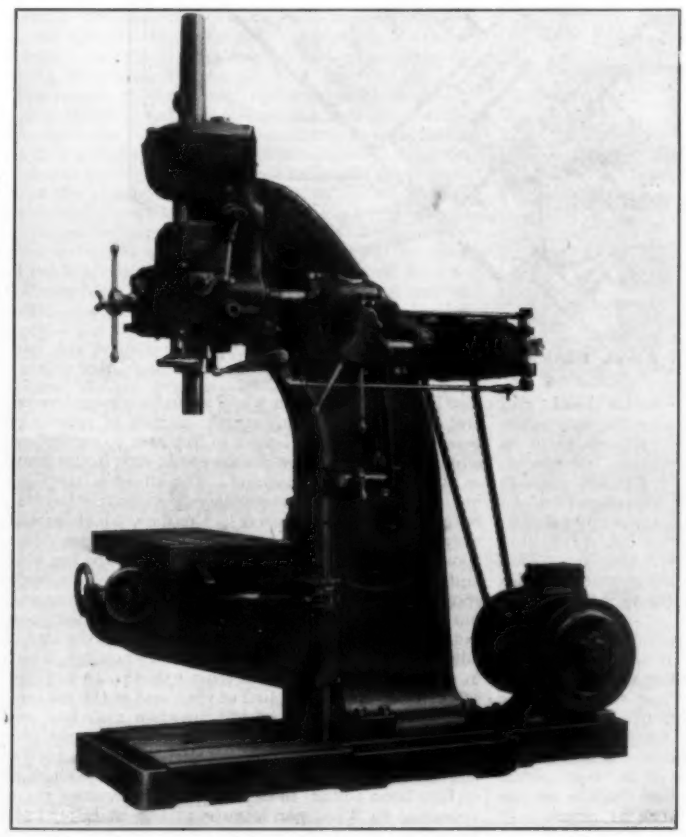


FIG. 51—VERTICAL DRILLING MACHINE—ASQUITH

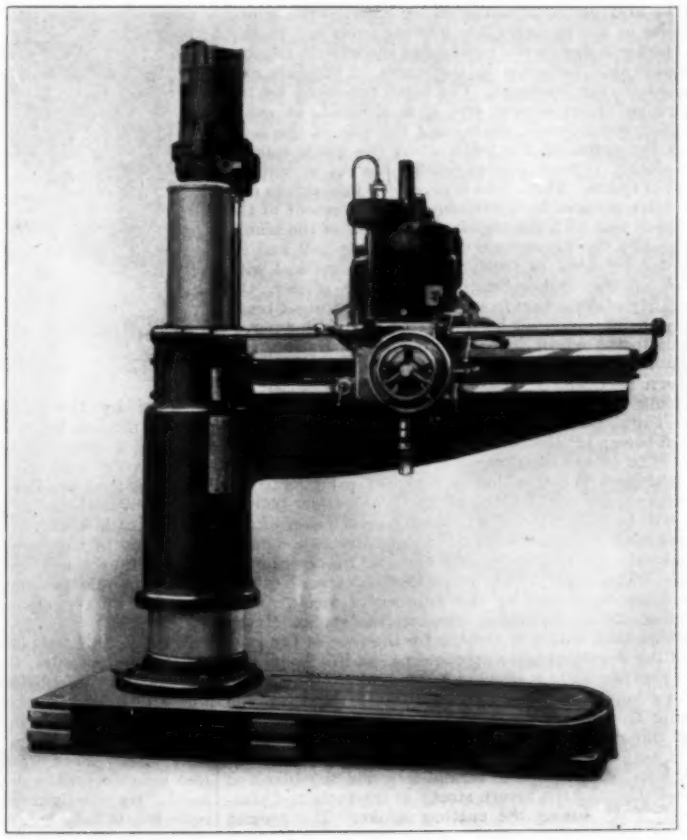


FIG. 52—RADIAL DRILLING MACHINE—ASQUITH

design has been so arranged that from a stock of standard parts it is possible to assemble immediately a simple machine of one speed and one feed or a machine of three speeds or six speeds with one or three feeds. The combined simultaneous locking of the arm on the column and of the slide on the arm is operated very easily and simply. The engagement of the column has two parts of different diameters, as also has the boss of the radial arm. Both the column and the bore are ground. This design of pillar and arm mounting eliminates the separate sleeve hitherto necessary and ensures a degree of rigidity when the arm is locked which, it is claimed, is unattainable in other designs of similar dimensions. When the lock- to run on two guides on the top face of the arm. The slide is moved along the arm by means of hand wheel situated at the front of the slide.

The spindle is of the six-splined form in the driving part and revolves in a barrel on a special arrangement of ball and roller bearings. An ejector is fitted to the spindle to release the drill or other tool without using

a drift. The feed rack is formed integral with the barrel from one piece of steel. The spindle drive is driven by a special two-speed electric motor through hardened and ground spur gearing. The spindle has a range of twenty-four speeds in either direction of rotation, which are obtained by employing change gears in the slide, giving twelve speeds, in conjunction with a reversible two-speed driving motor. One lever conveniently placed on the slide in conjunction with the two-speed motor enables the full range of twenty-four speeds to be selected, and this selection is facilitated as a result of a direct indicating speed chart. All sliding gears and layshafts are splined and no loose keys are employed. The controller and the selector switch for the spindle driving motor are placed on the slide, enabling fast and slow speed to be obtained in either direction of rotation, thereby eliminating reverse bevels, friction clutches and other mechanical reversing devices.

Tapping of large or small holes is efficiently carried out with this machine, which will tap holes up to 2in Whitworth in steel. The operator has complete control of the machine when tapping and can start, stop, or reverse the spindle instantly by a light touch of the hand. When the selector switch is thrown over the spindle controller gives a fast speed forward for drilling small holes. An automatic power feed to the spindle is provided at twelve different rates and is controlled by conveniently placed levers having a direct reading selection chart.

A power-operated feed locking motion is incorporated, and by merely pressing a button on the slide the arm is locked securely on the pillar, the slide is locked on the arm, and the automatic power feed is engaged. Pressing the button a second time disengages the feed and unlocks the slide and arm. A simple device is fitted which enables the power locking motions to be applied without engaging the automatic power feed. The arm and slide may in this way be securely locked, and fine hand feed or quick adjustment to the spindle be applied, as, for example, when tapping.

### SMITH AND COVENTRY (1927), LTD.

The principal machines exhibited by Smith and Coventry (1927), Ltd., of Timperley, near Manchester, are a spiral bevel gear planer, a keyseating and morticing machine, a keyway milling machine, and some milling machines and drills.

The bevel gear planing machine, which is illustrated in Figs. 65 and 66, page 318, and by the line drawings Figs. 54 and 55, has a capacity of 16in. diameter and a limiting gear ratio of 6 to 1. The dividing movement is made at each reciprocation of the tools. The spiral produced, it is claimed, is of the same mathematical accuracy as in the spiral spur gear. In many cases of spiral bevel gear cutting this condition is not met with, and an approximation is resorted to which results in the pressure line moving from end to end of the teeth during the rotation of the wheels, causing considerable variation in the angle of pressure and thrust on the bearings. The teeth produced by the machine under review are, it is claimed, at every section symmetrical, containing the axis of the gear, and the spiral of the teeth upon the pitch cone is absolutely correct geometrically, having a uniform lead of spiral. This effect is produced in a simple and effective manner by correlating the movement of the shaping tool with the angular movement of the blank. Primarily the movement of the shaping tool and its control for form of tooth produced is identical with that of the Robey-Smith bevel gear planer, the spirality of departure from the ordinary straight tooth bevel being produced by imparting an angular movement to the wheel during the cutting operation, this angular movement being obtained from the same quick return mechanism that gives the motion to the cutting tool. The correctness of the engagement of the spiral gears is ensured by making the change from the spiral lead of the pinion to that of the large wheel by means of change gears of exact ratio.

Although the machine is designed principally for cutting spiral bevels, straight teeth can easily be cut, as will be seen from the following description of the machine. The wheel blank is rotated by means of an angularly adjustable tangent plate and reciprocating slide. The angle of the plate and the stroke of the slide are regulated by the number of teeth of the pinion. The connection between the stroke of the cutting tool, which is decided by the face of the gear and the degree of spirality required, and the stroke of the dividing slide is effected by change gears mounted in a compound train. The number of studs on the swing frame and the position of the tangent plate determine the type of gear to be cut—whether straight or spiral bevel—and also the hand of the spiral required. When cutting straight bevels the blank is rotated during the return stroke of the tools and positively held during the cutting stroke. The reverse action takes place when cutting spirals, the blank rotating during the cutting stroke and being held during the return stroke. It is, naturally, necessary that the tools should swing clear of the work during the return stroke and provision is made for doing this mechanically.

The spiral angle of the teeth is accommodated by the setting of the cutting tools. With this object the entire tool holder with its relieving mechanism is arranged to swivel on the tool slide, the axis passing through the most important part of the cutting edge of the tools when held in their standard position. The cutting tools are of very simple form and are ground in a special fixture supplied with the machine, which, incidentally, can be applied to any standard cutter or tool grinding machine having a cup wheel. The automatic feed is operated by an oscillating slotted lever which is connected by a rod to a feed ratchet. The connecting-rod has a wide range of movements which can be selected by varying its position on the oscillating lever.

The duplex keyseating and morticing machine on this stand, which is illustrated by Figs. 67 and 68, page 318, is noteworthy on account of the absence of belts leading from the spindles, so that the insertion and removal of work is greatly facilitated and a much clearer view of the work whilst in progress is obtained. The simultaneous vice with which the work is gripped has, as will be observed in Fig. 68, an auxiliary clip which can be placed on the upper ends of the jaws holding the work. In this way a final definite locking of the vice is obtained without the necessity of abusing the right and left-hand screw which operates the jaws. The cutters are held in spring collets closed by a draw-back rod through the spindle. The spindles carrying the cutters run in self-adjusting double-cone bearings, with a parallel bearing at the end remote from the cutter. They are driven by bevel gears fully enclosed by the casting of the cutter head, and receive motion from a single constant-speed pulley through a change-speed box giving three rates of speed to the spindle, viz., 240, 400, and 700 revolutions per minute, the constant-speed pulley running at 480 revolutions per minute. The changes of speed may be made whilst the machine is running by a simple revolution of the hand crank on the long projecting bracket on the bed seen in Fig. 67. One revolution of this handle disengages the friction clutch, slides the gears into engagement and re-engages the friction clutch.

The spindle heads have ample traverse in the direction of the spindles, the maximum distance between the spindle noses being 15in. and the minimum distance 4in. The manipulation of these slides is by the crank seen at the right of Fig. 67, where it is shown in the position for moving the front spindle slide. This crank applied to the square which is seen just below operates the movement of the rear spindle head. By the tightening of a milled nut the spindle movements may be arranged to work simultaneously if keyseats are required on both sides of the shaft.

For producing mortices a special arrangement of the feed gear is provided and merely requires the movement of a small lever so as to make the two cutters approach the centre of the work simultaneously until they are about $\frac{1}{4}$in. apart. The traverse of the rear spindle head is then reversed and it is withdrawn, whilst the front spindle head continues its forward feed until the thin remaining wall is cut away. At this point a trip comes into action and stops the feed altogether. The different stages of this operation are clearly indicated by the position of the trip mechanism so that the setting up of work of this class is quite simple.

As this type of machine has occasionally to deal with heavy and long objects, the table has been made of a large size, with ample channels and T-slots, and has a support over its full length upon the bed of the machine, which is thus made as the base, instead of the overhanging table construction sometimes adopted. The table is given reciprocating movement of about 12in. by a substantial and directly connected crosshead. The position of the keyway in the length of the work is roughly decided by the position of the tailstock and the vice upon the machine table, the finer setting being effected by a rack and pinion movement in the connection between the crosshead and the work table.

The limitations of the usual elliptical gear for the traverse are overcome by a patented mechanism contained in the box carrying the disc and seen in Fig. 67. Underneath the disc is a large spur gear engaged by a spur wheel of half its size and carried loosely on an excentric journal on a vertical shaft. A series of discs are also arranged on this shaft, alternately journalled upon the shaft and on excentrics, and these discs transmit movement one to the other by pins with die: and radial slots in the discs. The lower disc has a bronze worm wheel upon its circumference, and runs at a constant speed, its rate of revolution being decided by the length of key seat to be formed, and controlled by loose change gears, seen in the guard at the front of the machine. The effect of the discs just described and their relatively excentric journals is to give a variable speed to the disc, which rotates very slowly at that portion of its revolution corresponding with the middle of the length of the key seat, and much more quickly at those points which correspond with the ends of the key seat. The resulting movement of the table is consequently much more uniform than has been found possible by the use of elliptical gears. The depth feed of the cutter, which in ordinary practice varies from 0·004in. to 0·016in. at each traverse, is applied at each end of the traverse by a cam contained in the traverse gear-box and operated by means of the long connecting-rod seen in Fig. 67, and the ratchet mechanism in the base of the front spindle head. In actual tests of the machine it has been found that the rate of traverse corresponding to 36in. per minute at the middle of the length can be safely used with all but the most delicate cutters.

As cottarways and mortices are often required to have tapered ends to suit the draught of the cottar, an attachment consisting of an auxiliary table can be placed on the main table, and is capable of a small angular movement. The auxiliary table is provided with T slots to hold the work, and the swivelling mechanism is operated in unison with the table traverse. As a consequence, when the table swivels uniformly on each side of its central position, the

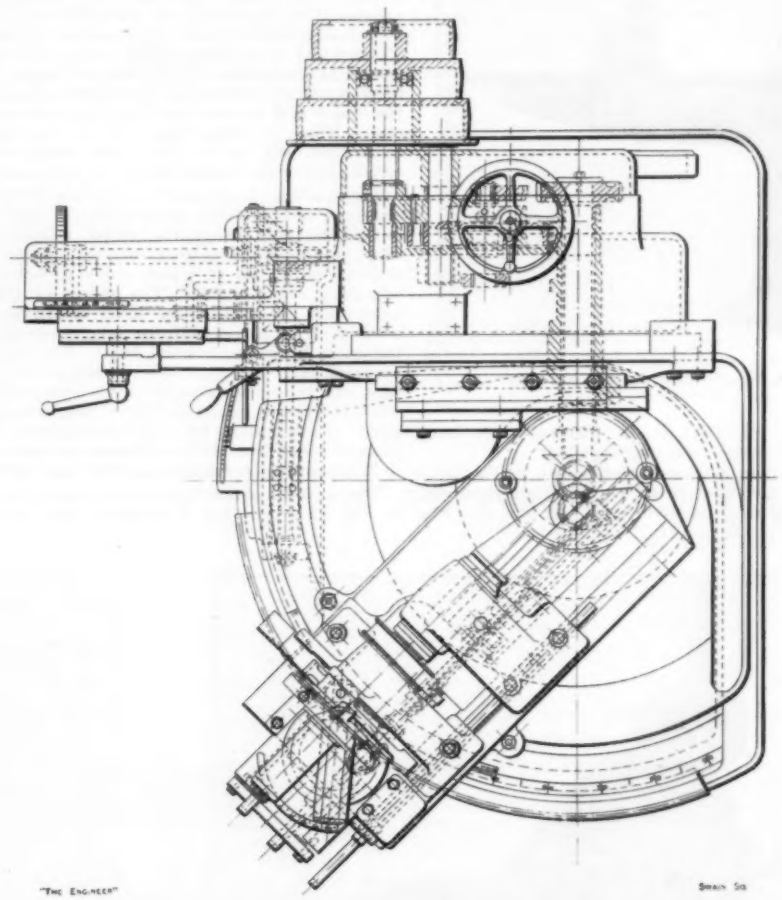



FIG. 54—SPIRAL BEVEL GEAR PLANER. PLAN—SMITH AND COVENTRY

resulting cottarway has a taper at both ends, and when a swivel is set to act all on the side of the central line, a taper is produced only at the end which is being machined when the swivel is greatest. The disc operating the swivel is graduated for tapers, and the connection to the feed drive gear is made by dropping the spiral pinion spindle on the universal shaft into the bearing provided on the traverse gear-box, shown in Fig. 67. The machine must be stopped at the instant of feed application to ensure correct timing of the two movements.

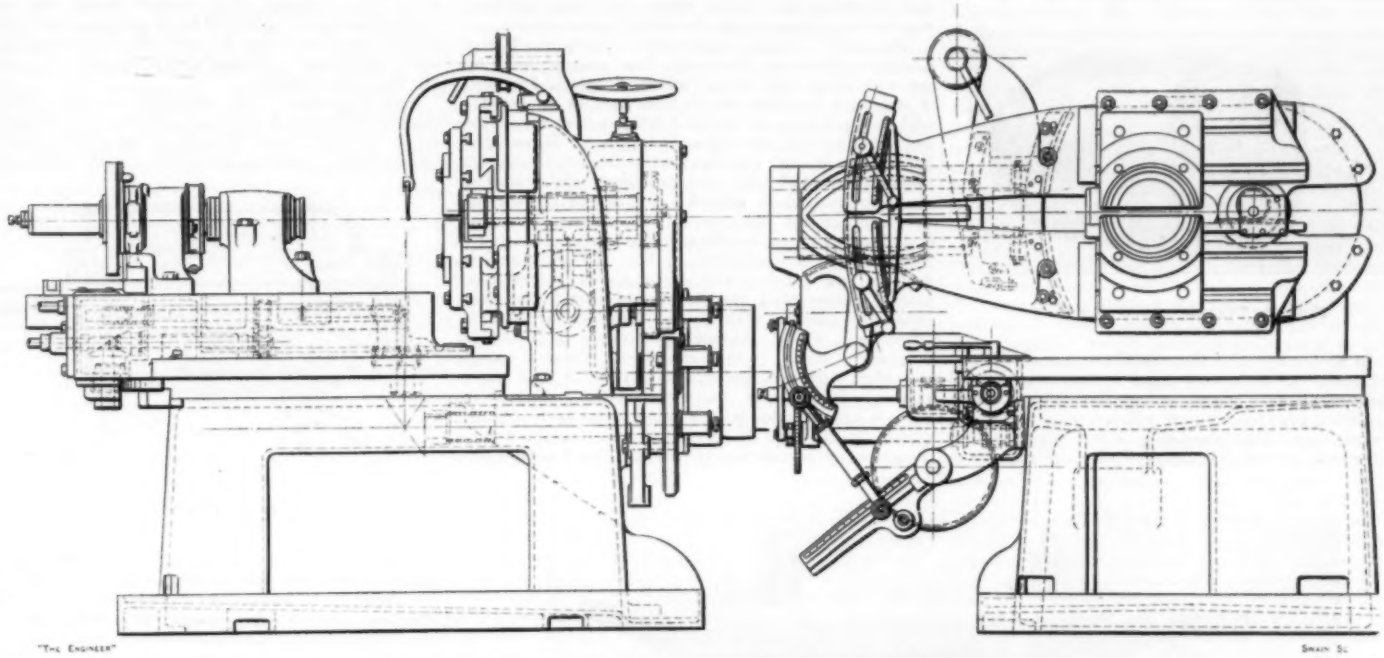


FIG. 55—SPIRAL BEVEL GEAR PLANER—SMITH AND COVENTRY

The general particulars of the machine are as follows:—Will cut cottarways in work up to 7in. diameter; table travel from zero to 12in.; table overall, 48in. by 12in.; table feed, double strokes per minute, 1·3 to 18; table to centre of spindle, 7in.; maximum distance between spindles, 15¼in.; minimum distance between spindles, 4in.; r.p.m. of spindles, 240, 400 and 693; feeds of spindle at each end of travel, 0·05in. to 0·004in.; driving pulley, 10in. by 3¼in.; r.p.m., 480; horse-power required, 5. Tapering attachment: Table, 31in. by 7¾in.; table top to spindle centres, 4in.; minimum distance between spindles, 7in.; taper of cottarway, zero to 1 in 8; floor space, 7ft. by 4ft. 9in.

The action of a keyway milling machine shown on this stand is entirely automatic, and it operates on a cycle as follows:—The cutter is first brought just down to the job and the depth required is set on the dial at the right-hand side. The length of keyway, minus the diameter of the cutter, is set on a steel rule carried on the bed. The machine is then started, and the cutter begins to feed down. When the depth set on the dial is reached, the vertical feed is dropped and the horizontal feed automatically put into action. The head then travels along the bed until it moves the distance set on the rule to the stop; that is, the length of the keyway, less the diameter of the cutter. When this point is reached the machine again automatically trips and the keyway is completed. The machine shown is arranged with a self-contained vertical variable-speed motor, driving through a totally enclosed worm reduction geared cone shaft behind the bed. The cutter head is traversed on the bed by hand through a hand wheel near the spindle or by a hand wheel at the right-hand end of the bed. The automatic feed is derived from a revolving nut inside the head. The spindle has a double cone bearing running in a gun-metal bush, which is adjustable to compensate for wear. It is controlled for vertical adjustment by a hand wheel in front of the head, and automatically by worm gearing fitted with sensitive automatic depth trip. A dial for setting the depth of keyway is fitted with a dead stop, so that any depth of slot may be predetermined. The rate of feed is regulated by two change wheels that vary the ratio between two shafts working on fixed centres.

The cutters are of a special end-milling type, and are gripped in the spindle by spring collets, operated by a draw bolt extending through to the top of the spindle. The machine exhibited is for keyways 1¼in. wide by 30in. long. On it the spindle has a vertical feed of 5in. and 10in. vertical adjustment to the table. The dimensions of the table are 2ft. 6in. by 10in.

### W. T. NICHOLSON AND CLIPPER COMPANY, LTD.

No fewer than 500 belts in the Exhibition are joined with this firm's "Klincha" belt fasteners, which are supplied in 12in. lengths containing eighty-four hooks. These belt fasteners are claimed to offer the advantage that they do not reduce the strength of the belt to the same extent as other fasteners, and they take a perfect staggered hold on the belt. Moreover, as they are made in 12in. lengths, they do not give rise to the same amount of wastage as would be experienced with short lengths. The wire hooks of which these fasteners are composed are attached to paper strips, which hold the hooks in the correct position, and the fasteners can readily be cut to any desired size. By alternating a long hook with a short hook, the holes in the two parts of the belt are staggered—that is to say, on a straight line across the belt there are 50 per cent. less holes than usual. An improved "Klincha" belt lacing machine to be seen on the stand embodies a detachable magazine which facilitates the insertion of the hooks into the machine when making a joint. The machine is also designed so that it can be operated with one hand, thus leaving the other hand free to hold the belt in the correct position whilst the joint is being made. Another exhibit is an improved "Klincha" vice tool, which is intended for small uses for belting. There are also improved "Klincha" belt cutters, which are made in two sizes, one for 6in. belts and the other for 10in. belts. They cut and square a belt with accuracy, thus obviating uneven strain on the belt when running.

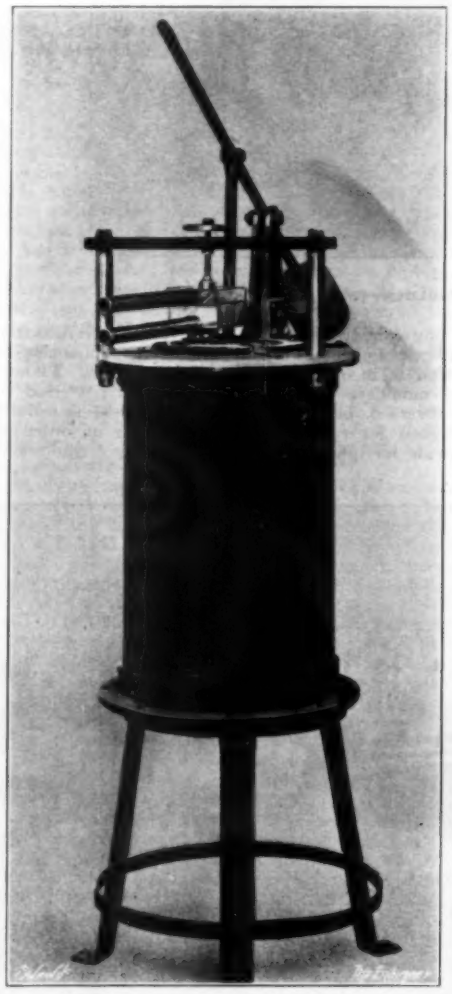


FIG. 56—DIE-CASTING FURNACE—A.E. FURNACES

### AUTOMATIC AND ELECTRIC FURNACES, LTD.

A new type of Wild-Barfield die-casting furnace—see Fig. 56—is exhibited by Automatic Electric Furnaces, Ltd., of Elecfurn Works, North-road, Holloway. It is intended for the white metalling of motor-car bearings under pressure. The container holds slightly over half a cwt. of metal, and the action of pumping the molten metal from this container ensures the intimate mixture, which is essential. Compared with the old method of ladling, the apparatus offers distinct advantages, both from the points of view of savings in metal and labour. But possibly the most important advantage is that machining and the cutting of oil ways is eliminated. The hand-operated pump gives sufficient pressure to reduce porosity to a minimum. The time required to heat the furnace from cold to its working temperature is 50 minutes, with a consumption of 3·5 kilowatts, but during operation the consumption is rather less than 3 kilowatts. The refractory heating chamber containing the metal pot is 8in. in diameter and 17in. deep. It is proposed to make the equipment in a large number of sizes.

### THE B.T.H. COMPANY.

From an electrical point of view one of the most interesting features of the Exhibition is the British Thomson-Houston Company's system of driving machine tools and wood-working machines by means of "built-in" motors. In conjunction with leading manufacturers of machine tools, this company has standardised stator and rotor units. The stators are built into the machine tools, and the rotors are mounted on the shafts by the machine tool makers, who provide the bearings, &c., which form integral parts of the tools. The rotor and stator units are shown in Figs. 57 and 58 respectively. The latter is a three-phase stator with a steel enclosing shell and the former a squirrel cage rotor with centrifugally cast aluminium bars and end rings. The units can be made for synchronous speeds of 750, 1500 and 3000 revolutions per minute when supplied with 50-cycle current at pressures up to 550 volts. Higher speeds can be obtained by supplying the motors with current at a suitable frequency by using a frequency changing set or a motor alternator set if the supply is a direct-current one. B.T.H. equipments of these

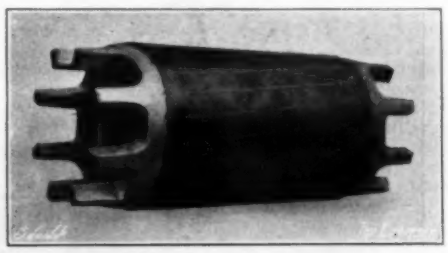


FIG. 57—ROTOR UNIT—B.T.H.

kinds, designed for giving supplies at frequencies of 60 to 100 or more cycles per second are in operation in various parts of the country.

The makers of these built-in motors point out that in addition to giving higher cutting speeds than are obtainable with other methods of driving, a separate

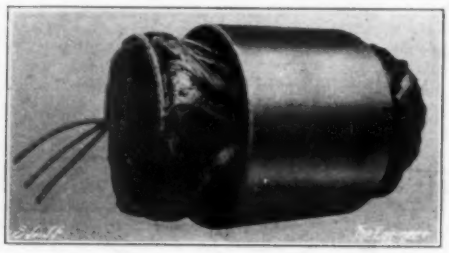


FIG. 58—STATOR UNIT—B.T.H.

drive to each section of the machine gives a self contained tool, which is very neat in appearance, and occupies small floor space, and as the drive is direct the highest possible overall efficiency is obtained. Moreover, there is no possibility of loss of production as the result of slipping belts, whilst the expensive

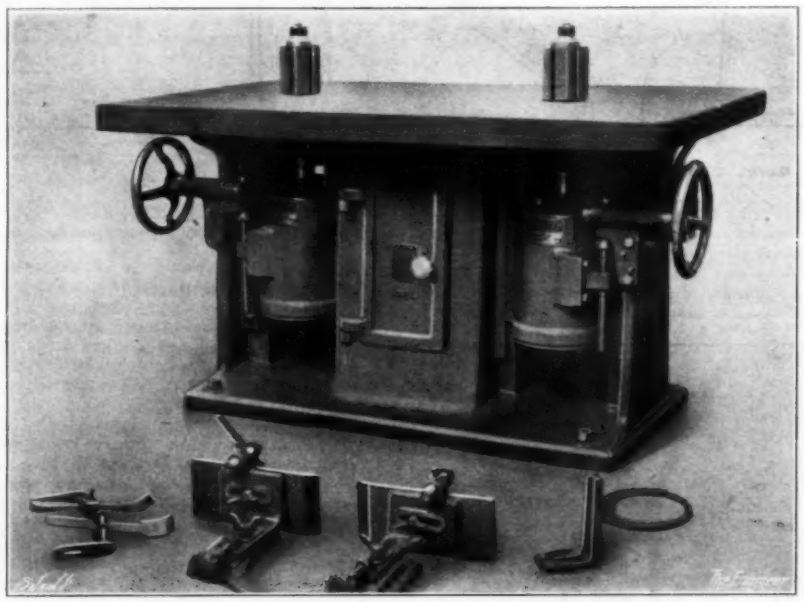


FIG. 59—ELECTRIC DOUBLE SPINDLE MOULDER—ROBINSON AND B.T.H.

items of belt adjustment, repair or replacement are avoided. Installation costs are also reduced. Many illustrations of machine tools equipped with these "built-in" motors have been supplied to us by the British Thomson-Houston Company, some of which are exhibited at Olympia. Among the wood working machine makers that seem to have a very good opinion of the scheme are Wadkin and Company, of Leicester; T. Sagar and Co., Ltd., of Halifax; and T. Robinson and Son, Ltd., of Rochdale. The latter firm is showing a double vertical spindle moulder with built-in motors—shown in Fig. 59. This is a new machine designed for working curved, irregular and straight mouldings, and it is made in different sizes with motors ranging from 3 to 5 horse-power, running at 7000 revolutions per minute on a 120-cycle circuit. The motors are started by connecting them direct to the supply, through triple-pole contactors. Overload and protection is provided by triple relays, and the machine is started and stopped with the aid of push buttons.

The motor control equipments which the British Thomson-Houston Company has standardised for use with these built-in motors are simple and reliable. A standard ironclad switch fuse acts as an isolator, and for motors up to about 5 horse-power contactors are provided for starting and stopping. If machines have to be started and stopped at frequent intervals, thermal overload relays are provided, whilst in other cases protection is afforded by a B.T.H. thermal overload circuit breaker. If occasional reversing is necessary, a lever handle reversing switch is mounted underneath the machine table. For machines such as saw benches and panel planers which have larger motors that can be started direct star-delta contactor starters with a time interlock are usually employed, whilst thermal protection is given by equipment similar to that described. Vertical spindle moulders with a single motor of from 3 to 5 horse-power, which must be reversed at frequent intervals, are provided with a hand-operated controller, giving one forward speed and one speed in the reverse direction by connecting the motor direct to the line. If, however, two speeds are required in each direction change-pole motors are provided, and a change-pole switch is incorporated in the equipment. Planers and moulders with several motors do not need to be reversed, but the electrical equipment is usually designed for reverse current breaking in order to provide for quick stopping. The control equipment time starts the time mechanism of the time relay. After a suitable interval the button is released, and the motor is connected in delta, and accelerates to full speed. But if the button should be released too quickly the time relay prevents the delta connection being made, and the motor is disconnected from the line. The braking effort which brings the motor quickly to rest is obtained by depressing the "stop" push button, and this has the effect of changing the motor windings to the star connection and of reversing the line connections.

The illustration—Figs. 60 and 61—shows a Wadkin electrically-driven tenoning machine with no fewer than five "built-in" motors designed for a 50-cycle three-phase supply. Each motor is fitted with ball bearings,

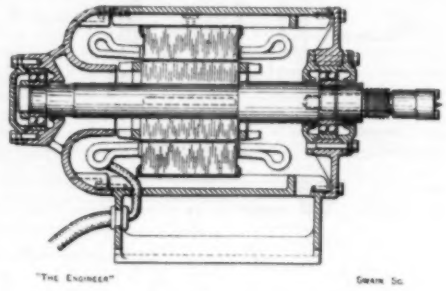
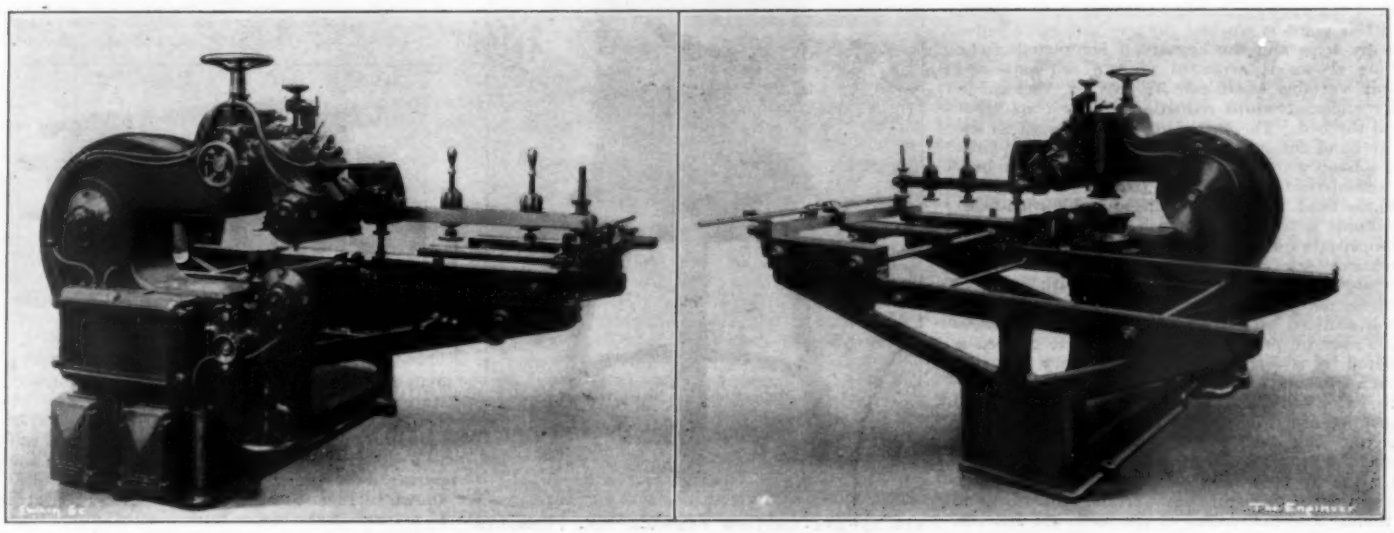


FIG. 62—BUILT-IN MOTOR—B.T.H.

and drives a cutter feed direct. All the motors, with the exception of that which drives the top scriber are rated at 2 horse-power, and run at a speed of 3000 revolutions per minute. The remaining motor is a 1 horse-power machine. As will be gathered from the illustration, the machine is entirely controlled by push buttons. Although the machines dealt with are for wood working, the application of these "built-in" motors are numerous. They are made for use with metal-working tools, grinding machines, boot and shoe machinery, &c. The drawing—Fig. 62—shows how a built-in motor can be applied to a lathe headstock.

*(To be continued.)*



FIGS. 60 AND 61—ELECTRIC TENONING MACHINE—WADKIN AND B.T.H.

## MECHANICALLY-OPERATED GARAGE.

WITH the enormous development in the use of motor vehicles in the United States—the number averaging about one car to every six persons, and even one car to every three persons in some cities—the problems of parking and garage facilities have become acute and difficult. Street parking is only temporary, at best, but large garages cannot often be built in business districts. Two ordinary methods of handling cars in garages are by lifts and by ramps—spiral or zigzag. But both of these methods are slow in buildings of more than eight or ten storeys, and it is not easy to drive safely up or down a long succession of ramps. A radical departure has been made in a tall office building in Chicago, where offices on four sides enclose a 22-storey central garage, which is completely isolated from the office space. Electric operation and automatic control are the features of the system. An entering car is stopped on a loading platform, where the owner locks it and leaves it. This platform tilts and runs the car into an elevator or lift. At a designated floor the door opens as the lift comes to rest and the platform tilts so that the car runs out on to a steel travelling platform, somewhat like a railway transfer table. Each table holds twelve cars, and there are two tables on each floor, with four lifts between them. To remove a car, push-button control causes the table to shift the car opposite a lift; its support tilts and runs it into the lift. At the bottom, the lift platform tilts and runs the car out into a driveway, where the owner boards it.

## The British Association.

(*Continued from page 293.*)

SUGGESTION SCHEMES TO PROMOTE CO-OPERATION BY WORKPEOPLE.

MR. S. MAVOR, in a paper before Section F (Economic Science and Statistics) on Thursday, September 6th, urged the value of "suggestion" schemes as a means of promoting individual co-operation by workpeople. National councils and committees of representatives of capital and labour, he said, meeting in London might do much to improve industrial relations, how much would depend chiefly on the willingness of both sides to sacrifice to the common cause present advantages, real or supposed. When national negotiating bodies had done their best, there would remain the real and basic task of giving in the workshops practical expression and effect to the awakened spirit of goodwill and co-operation. In the workshops goodwill was lost; in the workshops alone could it be regained. The initiative was with the employer, and it was already being widely exercised. A condition essential to success of effort in that direction was that a firm's relation to its employees should be inspired by human sympathy and consideration for the interests of the workers, and that all dealings should be governed by consistent fairness. Where that fundamental condition existed, many methods of promoting co-operation of the workers were practised with success, but he submitted that one of these—suggestion schemes—had received less attention than it deserved.

The purpose of a suggestion scheme was to induce workpeople to apply their intelligences to the work in hand, and to suggest how time, effort, or material might be saved in the doing of it. It was probably true to say that the greatest source of waste in the engineering industry was the comparative stagnation of the reservoir of latent mental abilities and mechanical aptitudes of the men in the workshops. The sluices should be opened, and streams of ideas should be made available for enhancing the workers' earnings and for reducing the cost and improving the quality of the products. "You are not paid for thinking," had been the too frequent snub by the wrong kind of foremen to men who had had the initiative to put their heads out of their shells. Management had not a monopoly of brains; workmen ought to be paid for thinking, and it was worth while so to pay them. It had been complained on behalf of the workers that under modern workshop conditions they did not have opportunity for self-expression, and that that is a cause of much industrial unrest.

A suggestion scheme gave the workman wide scope for his legitimate and laudable ambition to exercise his creative abilities, and to stamp his own individuality upon his work. It was a channel through which he could make personal contributions to technical progress, and so have a conscious share and proper pride in promoting the general advance, while reaping immediate and appropriate reward for his effort. The fuller exercise of his faculties was a source of pleasure to a workman. It increased his self-respect, and enabled him the better to realise his place in the industrial and social structure. Suggestion schemes contained large possibilities of fostering goodwill and practical co-operation of the workpeople, and of promoting industrial harmony. They provided opportunities to the workers of increasing the value of their contribution to industry, and of enhancing their earnings by adding the work of their heads to the work of their hands.

THE MEASUREMENT OF FLAME TEMPERATURES.

In a paper on this subject before Section A (Mathematical and Physical Science) on Thursday, September 6th, Dr. Ezer Griffiths, F.R.S., and Mr. J. H. Awbery (of the National Physical Laboratory) discussed two methods which have been employed for the measurement of the temperature of a homogeneous flame. In the one, a refractory metal in the form of wire is heated electrically in vacuo, and the relation between temperature and heating current determined by an optical pyrometer. The same wire is then inserted in the flame, and the relation between temperature and heating current again determined. When the results are plotted graphically the point of intersection of the two lines will give the temperature of the flame, for at the temperature represented by this point the electrical supply is sufficient to balance the radiation loss, whether the wire is in vacuo or in the flame, so that the surrounding gas in the flame neither imparts nor abstracts heat from the wire. Experiments have been made using wires of different diameters, and these have given identical values for the temperature of the flame investigated within the limits of experimental error.

In the second method a beam of light from an incandescent tungsten sphere was focussed through the flame on to the slit of a spectroscope. Sodium was introduced into the flame, and when the temperature of the flame was greater than that of the tungsten sphere, bright sodium lines showed up on a continuous spectrum background. If the temperature were lower, reversal of the sodium lines took place. By careful adjustment of the temperature of the tungsten sphere a point was reached when all trace of either bright or dark lines disappeared. This balance could be effected within a range of a few degrees. The corresponding temperature of the sphere was then determined by means of an optical pyrometer.

The first question studied was the influence of flame thickness, and it was found that the method gave results independent of the thickness of the flame. The second series of experiments was directed towards answering the question whether the temperature obtained in the spectrum-line reversal method was independent of the particular spectrum line employed. For this purpose the red lithium line and the yellow sodium lines were utilised. To obtain satisfactory reversals with the lithium line, a thick flame from a water-cooled burner, 10in. in length, was used. Separate experiments were made in which sodium and lithium salts were sprayed in the gas supply to the burner, and the red and yellow lines were also obtained simultaneously by using a solution of both salts in the spray. It was found that the temperatures obtained were the same whether the red or the yellow lines were employed as indicators. The lines used were principal lines of a spectral series, and, it was pointed out, the conclusion may be applicable to these lines alone.

The third series of observations was made on heterogeneous flames. Two flames at different temperatures were measured individually, and then superimposed and again measured. A mathematical investigation was also made of the problem and a formula deduced for the "apparent" temperature of two superimposed flames from the individual values. A comparison of the observed and calculated data showed satisfactory agreement. The authors pointed out that the value obtained for the "apparent" temperature of two superimposed flames differs markedly from the mean of the two individual temperatures, and is dependent on the relative positions of the flames. It would appear, therefore, that the method cannot be applied to estimate the average temperature of a heterogeneous flame.

A noteworthy feature of this method of measuring temperature is that it is devoid of "time lag," and so, for example, may prove of value in measuring temperatures in the explosion cycle of an internal combustion engine.

Some preliminary experiments have been carried out in conjunction with Mr. Fenning, of the engineering department of the National Physical Laboratory, to test this application of the method, and gave quite promising results. The "match" could be adjusted by successive trials in a series of five or six explosions.

SOME ASPECTS OF ROAD AND RAIL TRANSPORT.

Road and rail transport was discussed in a paper by Dr. K. G. Fenelon, Lecturer on Economics, Edinburgh University, before Section F (Economic Science and Statistics) on Friday, September 7th. At present it is generally felt, said Dr. Fenelon, that the transport situation in Great Britain is in many ways unsatisfactory, and that the best use is not being made of the facilities available. The problem is a complex and difficult one, but he singled out two factors as being of especial importance—(1) the rise of road transport, and (2) railway traffic losses owing to trade depression. Discussing the relation of the new road transport to the railways, the author asked, "Is there to be a struggle in which the stronger will survive after a long war of attrition, in which the community would suffer considerable loss, or is it possible to substitute some system of co-ordination or co-operation whereby the two methods would be able to work in harmony?"

Railway depression, he continued, has naturally an important bearing on the question. The railways are still the backbone of inland transport facilities in Great Britain, and in consequence this depression is a matter of grave importance to the community. Coal, iron and steel traffic has fallen off very greatly, and the importance of it to the railways is evidenced by the fact that even in 1927 coal traffic constituted 50·25 per cent. of the total freight ton-miles carried by the railways. Loss of traffic in coal and similar freights and lost revenues from workmen's tickets, are clearly due to trade depression and not to road transport competition. A revival in the heavy industries would do a great deal to improve railway finances.

The railways have also lost traffic to the roads. Though road transport is complementary as well as competitive with the railways, it is clear that on balance the railways have been the losers. Especially disquieting to the railways must be the fact that motor omnibuses can be operated successfully at fares of 1d. per mile, as compared with the ordinary third-class railway fare of 1½d., and can afford to give appreciable reductions for return tickets. Parcels, newspaper and some other traffics have increased, however, since 1923, showing that where the railways can give special facilities and fast service traffic can be retained and even increased. Road competition has been felt by railway administrations in many other countries, and indeed is now general in all parts of the world. Loss of traffic is a serious matter to the railways, because the industry is one in which fixed charges constitute a very high proportion of the total costs of carriage.

As a possible solution of the road *versus* rail controversy there has been an increasing tendency to search for some compromise whereby the two methods of transport could be co-ordinated to their mutual advantage, and to the benefit of the public. Competition has not furnished a solution, and experience has shown that unnecessary duplications of services exist and that the best use is not being made of the available facilities. Rival enterprises may starve each other of traffic, costs may be swollen by duplicate administrations, &c. Where competition is severe there is often a tendency to concentrate on the best paying routes, and to neglect the leaner routes.

If co-operation were substituted for competition, arrangements could be made whereby each system would operate under the conditions most suitable to its economic characteristics. With a co-ordinated transport system it would be logical to treat each natural traffic area as one unit, feeder and development services being operated in conjunction with the main traffic routes. In many other ways, also, the advantages of co-ordination over unregulated competition can be shown to be considerable. The difficulty, however, is to find a scheme of co-operation which would secure all the advantages of co-ordination, but which would not check the legitimate development of road transport and would not be injurious to the public. In the past the problem of co-ordination was comparatively easy of solution, since there was a more or less clear demarcation between rail and horse transport. During a transitional period co-ordination is difficult to achieve, though, if a static period follows, the problem is greatly simplified.

The fact that the various types of transport have each certain advantages and limitations for the carriage of particular types of traffic and for use in certain circumstances provides the economic basis of co-ordination. There is a differentiation in function between each of the principal forms. If there were no such differentiation there would be no case for co-ordination on economic grounds, because if one form of transport were superior for all purposes the sooner it was generally adopted the better. Co-ordination in such circumstances could be urged only as a temporary expedient, to ease the transition of labour and capital from one form to the other. There are many practical difficulties in the way of evolving a logical system of co-ordination, and in only one country—Germany—can it be said that a definite attempt has been made to co-ordinate rail, road, air, and inland water transport. The spheres of road and rail transport overlap, and each seeks to obtain a large part of the debatable margin for itself, since fixed capital previously sunk in the enterprise has to be remunerated. The multiplicity of road transport undertakings and the ease with which new enterprises can be started considerably increase the difficulties of inaugurating a system of co-ordination.

Co-ordination might be achieved in a variety of ways, but broadly speaking, the various schemes may be divided into three categories. Firstly, co-ordination might take the form of voluntary co-operation between road and rail undertakings, including municipalities, each maintaining its separate identity. In this type of co-ordination road and rail would be more or less equal partners. Secondly, co-ordination might be achieved through the provision of motor services by railway companies or through financial control of road concerns by railways. In this form of co-ordination road transport would be definitely subsidiary to the railways. Thirdly, co-ordination might be quasi-legal in character. The scheme put forward by the London Traffic Advisory Committee is of this nature.

Voluntary co-operation would have considerable advantages, in that the complementary characteristics of road and rail would be stressed rather than the competitive. Mutual facilities could be provided, such as the use of each other's booking offices for through journeys, use of stations, dovetailing of time-tables, &c. Though a certain amount of co-operation has been effected in some districts, it has been difficult to achieve on an extensive scale. For one thing, rivalries and jealousies prevent the two interests from coming together. The railways naturally wish to subordinate road transport, but the operators of the latter can hardly be expected to give up lucrative traffic on the main routes and to become merely feeders to the railways. Another important difficulty is that any co-ordinated arrangement between a railway and a road transport concern is liable to be attacked by outside enterprises.

Dealing with the second type of co-ordination, involving railway ownership or control of road transport, Dr. Fenelon said that from the point of view of railway operating economics there are many uses to which a subsidiary road transport service could be put by a railway administration. Road services could be substituted for unremunerative branch lines, which in some districts are a serious financial drain on the companies. Circuitous rail routes could be avoided. In Germany, America, Switzerland and France, where statutory restrictions on the railways have been less onerous, the railways have made a more extensive use of road transport. Complete co-ordination on these lines would mean a monopoly of transport services by the railways, and this is the very ground on which the greatest exception has been taken to the grant of extended road powers to the railways. The Railways Act, 1921, was intended—though in practice it has not achieved the object—to grant a regulated monopoly to each of the groups in their own area. Opinion, however, has now hardened in the opposite direction, and because of the fear of monopoly there would

seem to be insuperable difficulties in the adoption of this type of road and rail co-ordination.

In the third form of co-ordination—that of a quasi-legal character—the various transport concerns would be required to compose their differences and to evolve a system of co-operative working. Failing voluntary agreement, authority would step in and set up a compulsory scheme of co-ordination. This would mean the recognition of some form of monopoly, of compulsory participation in the scheme, and of some measure of control in the public interest. Presumably the country would be divided up into districts, each of which would be a natural traffic area including the main routes and their traffic tributaries. The main difficulty of quasi-legal co-ordination is that, on the one hand, if a central body were appointed for the whole country it would be practically impossible to exercise due control, on account of the magnitude of the task, or to steer clear of the dangers of routine and red tape, while, on the other hand, if regional committees were set up there would be difficulties owing to the fact that the railways transcend local boundaries.

From the point of view of the public, certain limitations may attach to co-ordination policies. A monopoly might be gained which could be exploited at the expense of the public. This might mean the bolstering up of inefficient enterprises, the checking of innovations and improvements, and the increase of rates and fares. It is more than probable, therefore, that the evolution of any scheme of co-ordination on a general scale, whatever be its exact nature, would result in a demand for governmental intervention. Some public body would have to be set up to control the co-ordinated transport in the public interest.

The indications at present are that some form of co-operation will have to be adopted, and if the various transport interests cannot themselves introduce some system the task will have to be undertaken by an outside body. The demand is most urgent in the case of city transport, and here the probable solution is that of quasi-legal co-ordination on the basis of regional or urban traffic areas. The wider question of co-ordination throughout the country is more difficult of solution. There is on the whole much to be gained by the adoption of a co-ordinated policy, though some method of control is probably essential.

The easiest solution would be voluntary co-operation between the railways and the large motor transport concerns, which latter, especially in the case of passenger transport, have been tending to oust the smaller concerns during the past year or so. To protect the public interest in the event of such a combination becoming over-powerful some public committee or authority would have to be set up.

### Heavy Oil Engines for Aircraft and Railways.

In a paper dealing with the use of heavy oil engines for aircraft and railways presented by Mr. A. E. L. Chorlton, of W. Beardmore and Co., Ltd., on Monday, September 10th, the author said that the main attraction of that type of engine for aeronautical purposes was its safety, owing to the fact that it did not use a volatile fuel like petrol, and also its high economy in reduced consumption, apart from the employment of a lower-priced fuel. Hence, its great advantage for flights of long duration. Compression ignition engines, in which the injection was airless and the fuel was sprayed by being forced through an atomiser by a pump under heavy pressure were a gradual but distinct development of the original engine of Akroyd Stuart, whose patent was taken out before that of Diesel. That was a well-known engine, but it was often forgotten what it had led up to. The Germans at the present moment were experimenting with such engines for lorry work, but no acknowledgment was being given to the work of Ackroyd Stuart.

The practical difficulty in that type of engine was the effective combustion of such oil sprays in an extremely confined combustion chamber, and if wall contact was to be avoided and a high mean effective pressure obtained, the problem was still more difficult. The brake mean effective pressure for air work must always be at least 100 lb. per square inch, and preferably as high as 120 lb. It was therefore obvious that all the air possible must be in a position in which it could be permeated by the oil spray. The excess air, furthermore, was one of the governing factors in economy; hence, as the volume capable of being attacked by the oil became less and less, particularly if the combustion chamber was irregularly shaped, economy suffered. The permeation and penetration of the oil injected into the air must be thorough in all respects, yet no interference of the jets must take place. That requirement affected the position of the fuel atomiser or sprayer, and it was necessary to consider whether, in the case of a single sprayer, it should be placed at the centre or circumference, and also if one or more should be used. A number of fine jets gave quick burning, but there was risk of interference and lack of penetration. Though turbulence played an important *rôle*, it was doubtful whether it did so to the same extent as in the case of lower compression engines with a carburetted mixture.

After a long period of development work, W. Beardmore and Co., Ltd., had evolved a satisfactory engine of that type, some results of which were given before the Institution of Mechanical Engineers in March, 1926. Those tests showed a fuel consumption of ·35 lb. of fuel per B.H.P. hour. Since then, however, further progress had been made in the reduction of the fuel consumption. The figure of ·35 lb. of fuel per B.H.P. hour meant an efficiency of 40 per cent., but a figure of ·32 lb. per B.H.P. hour had been obtained. That figure had been carefully checked and represented the lowest fuel consumption that had ever been recorded. The general characteristics of engines of that type, as specially constructed for airships, were eight cylinders in line, 8¼in. bore by 12in. stroke, giving 650 H.P. at 1000 r.p.m. The crank case was of the monobloc type, and, when a steel casing was used, the weight of the engine was 4600 lb., whilst with an aluminium casing the weight was 3600 lb.

The oil fuel pump employed in the engine was the most characteristic feature of the whole design. It was held by the author at the beginning of the experimental work that for multi-cylinder engines running at high speed and having a fuel pump delivering but small quantities, the design of that part should be on the lines of a measuring apparatus, and that the normal suction and delivery valves of the seated type, lifted by variation in oil pressure, could not be relied upon to give constant and similar delivery to all cylinders. He therefore designed a pump in which all the motion is derived from cranks, so that there is no lost motion and all the functions start and remain the same under all conditions. The variation in amount delivered corresponding to the load is obtained by revolving the valve, which has helical cut-off edges working against a suitable port. This valve operating across the suction passage blocks it momentarily, so to speak, in its quick travel across the feed port, whereupon the injection takes place with great force and rapidity. Four pumps feed eight cylinders, and a switch valve—fitted between the pump and the two atomisers—ensures correct timing of the injection of fuel to each of the two cylinders.

The author then gave descriptions of the airship type of engine, the engines for the Canadian National Railway, and the experimental engine on the L.M. and S. Railway.

Professor A. L. Mellanby, opening the discussion, said, having been connected with the work, he could endorse the test figures given by the author. From a careful check of the work that had been done, and after endeavouring to make the fuel consumption as high as posaible, his own opinion was that the published results were, if anything, a little higher than those actually obtained.

Mr. J. S. Brown, who assisted Professor Mellanby in the work, spoke to the same effect.

Sir Henry Fowler said it was too early yet to speak of the results on the line to which reference had been made, as the train had only been running since July 25th, on the whole satisfactorily. Such small troubles as there had been had not been due to any large extent to the engine. The train was running about 150 miles per day. One trouble which he had anticipated rather more than Mr. Chorlton was with regard to acceleration, because it was not the same as with a steam engine. Serious tests in that respect, however, had yet to be made. The conditions on his line were entirely different from those on the Canadian railways where the branch lines, upon which that type of engine was employed, were 200 or 300 miles long, and the traffic was small. The most important aspect of the whole matter was the economic standpoint. Mr. Chorlton had spoken of the beautiful simplicity of electric transmission, but Sir Dugald Clerk recently had spoken of the loss of efficiency through using electric gear. Personally, he complained about the extra cost very strongly indeed, and it would be a great advantage to have a type of transmission which was a great deal cheaper having regard to the cost of interest, depreciation and maintenance associated with electric transmission. Later on, he hoped to give fuller details of the L.M. and S. experiment.

Mr. R. G. Gage (Canadian National Railways) said that Beardmore engines had been used by his company for three years on branch lines ranging from 100 to 350 miles long. The traffic was relatively light and the number of stops few. Altogether there were fourteen such locomotives in use at present, from 200 to 400 B.H.P. The 1500 horse-power engines were not yet on the road. One important question concerning the operation of such engines was that of bearings. The combustion problem had been by no means the most important problem on the Canadian railways, but he believed that all makers of Diesel engines were concerned about the bearings on the big ends. That was a question which required careful study and research, because at present he did not think the possibility of trouble owing to the failure in service of big end bearings had been eliminated. It seemed to be a matter of design and the proper use of metals, how the Babbitting should be done and whether the shell should be bronze or steel. Certain it was that a solution of that problem had not yet been found. However, the Canadian railways felt justified in the course they had adopted, because the results so far had been entirely satisfactory.

Wing Commander T. R. Cave-Brown-Cave, discussing Mr. Chorlton's paper before giving one of his own dealing with the evaporative cooling of aero-engines, claimed that the development of the heavy fuel oil engine for aircraft purposes had eliminated the fire problem. Another advantage was that whereas with an ordinary petrol engine on aircraft, the consumption of fuel was about ·6 lb. per brake horse-power, in the case of the heavy fuel oil engine it was ·4 lb., or a reduction of more than 30 per cent. An incidental advantage, also, was the reduction in the volume of fuel tanks. Yet another great advantage was that, whereas aviation spirit cost 1s. 9d. per gallon, or £25 per ton, fuel oil was bought for £5 per ton and could be obtained anywhere in the world. Referring to the engine mentioned in Mr. Chorlton's paper as having six cylinders and a weight of approximately 3 lb. per horse-power, he asked if it was in existence yet.

Professor W. Kerr (Royal Technical College, Glasgow) discussed the problem of torsional vibration and expressed surprise at the haphazard manner in which designers and builders of such engines dealt with that problem. There was, he said, a failure to appreciate the necessity to deal with the data available in a proper scientific spirit. It was possible in every case to make simple practical experiments in order to gather the necessary data for subsequent analysis.

Mr. H. E. Wimperis spoke of the manner in which the weight of engines for aircraft had gradually been brought down from 5 lb. per horse-power to 1 lb. per horse-power. Referring to the figures of tests which were published in the author's Institution of Mechanical Engineer's paper in 1926, he asked why there was such a change of brake horse-power when the engine went from Shell-Mex oil to Anglo-Persian, viz., from 160·26 and 172 brake horse-power in two tests on the former to 424 and 263 in two tests on the latter. Replying to Professor Kerr, he stated that he must be imperfectly informed as to what had been and was being done with regard to torsional vibration of crank shafts. The Air Ministry had an Aeronautical Research Committee which had arranged a number of sub-committees to deal with different problems. One of these sub-committees dealt with torsional vibration of crank shafts. The question had been gone into very fully and a great deal of money had been spent upon it; he could assure Professor Kerr that all the obvious things in that connection had already been done.

Mr. Chorlton, replying to the discussion, said most people spoke of acceleration in making comparisons of the nature of those made by Sir Henry Fowler. It was necessary, however, to view the problem as a whole. To get greater acceleration on the L.M. and S. locomotive it was only necessary to put in a bigger power unit, but it would not be worth it. The point was that the train in question was easily maintaining the old steam schedule at roughly 3d. per mile in fuel, it displaced three locomotives and saved £10 per week in wages. The acceleration was limited merely by the way the generator and motor were wound. The design of big end bearings mentioned by Mr. Gage was an important factor in all high-speed design, but a good deal of experience had been acquired on that subject. He had no doubt that the weight of those engines could be brought down at the moment to 2¼ lb. per horse-power if the endeavour was made to construct a really light engine. It would, however, necessitate a change of type of engine.

### The Cooling of Aero-Engines.

Wing Commander Cave-Brown-Cave presented a paper on "The Evaporative Cooling of Aero-engines," with special reference to the Tornado engine which had been described in Mr. Chorlton's paper. That engine, he said, would, when installed in airship R.101, be arranged with a system of cooling which differed from that usual in water-cooled engines. Water would be circulated through the engine, but it would pass away as steam. In the normal water-cooled engine the waste heat transmitted through the cylinder walls was carried away as sensible heat in the jacket water, and conveyed to a radiator from which it was dissipated to the passing air. The dissipation of that waste heat was, therefore, achieved at the expense of a considerable weight of water in the radiator and connecting pipes. In the evaporative system a normal water-cooled engine was used, but the waste heat was carried away as the latent heat of a comparatively small weight of steam, actually evaporated during the circulation of water through the cylinder jackets. The water circulating round the engine was always at a boiling point; it was the steam only which passed to the radiator.

The fact that the steam conveying the waste heat was so extremely light, made it possible to use for dissipation to the air the most effective parts of the outer cover of an airship, and allowed the dissipating surfaces themselves to take a form, which would be quite impossible if liquid water were used as the vehicle. The system was first applied to an experimental unit at the Royal Airship Works, and had been reproduced with very minor alteration in the power unit which was undergoing test preparatory to installation in R.101. Various types of aero-engines had undergone tests with this evaporative system and had developed their full power without any modification of the engine.

### The Position of Skill in Industry.

The present position of skill in industry was the subject discussed at the joint meeting of Section F (Economics) and Section J (Psychology) on Monday, September 10th.

Professor T. H. Fear opened the discussion and defined skill as an integration of well-adjusted responses, excluding from the word "skill" any badly-adapted responses. It implied, he said, two rather

different things—power and knowledge. The consciousness of added power could not fail to widen one's personality. Skill might become a bargaining asset. While some bargaining assets were based on realities, some depended upon bluff, conscious or unconscious. Some large-scale examples were seen in the collapse of the General Strike of 1926.

As a bargaining asset, many low-grade skills had no value. Mr. Ford had shown that 85 per cent. of the jobs in his works required not more than two weeks for proficiency to be attained. That led to easy replacement, and the worker might feel that his personal value to the community was small. There was quite a definite difference of opinion with regard to the place of skill in industry to-day. Some argued that there was a decrease of both skill and muscular knowledge in industry, which decrease was wholly bad; others gratefully acknowledged the fact that many people did not seem to mind losing both. Could we see a middle course? Professor Pear appeared to suggest that skill in industry was decreasing, which was a bad omen.

Professor H. Clay said that Professor Pear seemed to have suggested that industrial skill was becoming of less economical importance, and was diminishing in extent, and he himself was inclined to agree. In both its elements, manipulation and knowledge, it was subject to a continuous invasion; the area in which manipulative dexterity was necessary to efficient production was constantly being reduced by the spread of mechanism. As soon as a task became mechanical it was possible to construct a machine which would do it more accurately and more rapidly than the human machine. Similarly, the skilled man's empirical and, therefore, personal knowledge was constantly being superseded by scientific and, therefore, universally accessible knowledge. While there were limits to the elimination of skill from industry the tendency was in the direction of elimination. The considerations that explained the decline of skill indicated also its present function in industry.

Skill was required for the many kinds of work that could not be reduced to routine, and the scope of routine production depended on the volume of uniform production that industry undertook. While routine production tended to expand with the widening of the circle of commercial exchange and the standardisation of commodities, the expansion always left part of the field of production to skilled labour, and usually created some demand for new skilled labour. All industrial production that might be organised on a basis of routine labour was not, however, so organised at present. Many commodities that might be so produced were, indeed, over a large part of the field of industry competing alternatives. Which alternative was adopted depended mainly on the available labour supplies.

It was easy to exaggerate, however, the extent to which skill was being eliminated. That exaggeration took two forms—an exaggeration of the extent and degree of skill involved in the displaced methods, and an under-estimate of the extent and degree of skill involved in the new methods.

There was a sentimental view of the Middle Ages, he said, which regarded them as a period in which every workman could be an artist, whereas in fact the great majority of the population was engaged in a desperate struggle for existence on the land. Scientific discovery and economic development had relieved us of that struggle. We had resources which would enable us to maintain in creative work all the artisans who were capable of being artists, if we did not prefer a cheap and nasty abundance. If, therefore, there were any case for preserving the traditional skills, the first need was the education of the consumer in the absolute value of the products of skill.

Mr. C. G. Renold, of Hans Renold, Ltd., Manchester, regarded Professor Pear's definition of skill as a very narrow one, and one which ruled out many combinations of qualities to which, in industry, it was customary to apply the term. It was to be used, apparently, only with reference to the performance of physical acts of a relatively difficult or complicated nature, which were controlled by knowledge that had been absorbed into one's physical being, and operated more or less automatically. It must be admitted that skill in that narrow sense—the "skill of the cunning workman"—was less and less required in modern industry.

He would prefer to call skill, as defined by Professor Pear, by the name of "dexterity," and to reserve the term "skill" for a broader combination of qualities. In industry the term "skill," though admittedly used rather loosely, had a very real meaning, which might be stated as "a combination, useful to industry, of mental and physical qualities which required considerable training to acquire." It was generally a combination of conscious knowledge and dexterity. Either might predominate and the other be of a relatively low order, but the level of the combination must be fairly high.

If "skill" were merely "dexterity," then he did not see that its disappearance from industry was of any great moment. It was true that the exercise of dexterity did give one a glow of satisfaction, but it was not the only vehicle of self-expression in work. Satisfaction in work, he suggested, came from two things—the doing well of something that was difficult and the freedom to exercise some degree of choice. The difficult thing done need not necessarily be physical; there was a great satisfaction to be derived from work in which the main requirement was the correct use of knowledge.

In his view, the social problem which was involved in the mechanisation of industry turned on whether skill, in the sense in which he used the term, was fated to disappear, rather than on the elimination of physical dexterity. It was true that many kinds of skill which formerly were necessary were being eliminated from industry. The picture which was conjured up by Mr. Ford's development, he suggested, was distorted, and the conclusions which seemed so naturally to follow from it were not nearly so inevitable as they appeared. It must be remembered that to keep Mr. Ford's works going there were very many other shops occupied in making machines and tools for him, and that much of such work could not be reduced to a mass production basis, but required a good deal of the engineering craftsman's skill. It also required a fairly high proportion of designing skill. Further, the reducing of manufacture to mass production involved the development of an organisation of control, with a refinement of clerical methods, that introduced large new fields of skill. There was also the need for greater regularity of raw materials and of all the various supplies used, and that meant that all Mr. Ford's suppliers were having to go in for more and more work of a scientific laboratory nature in order to be able to conform to his necessarily stringent specifications. Moreover, as soon as production had been placed on a mass basis, the problem of creating markets and selling the goods became acute, and the modern selling methods which had resulted required a high level of skill on the part of large numbers of people.

He was inclined to think that if all the ramifications of Mr. Ford's suppliers of material and equipment could be traced out, and the selling staffs of all were also taken into account, it would be found that the degree to which skill of one kind or another entered into the complex had not changed nearly as much as would appear at first sight from what it was when Mr. Ford was a small man making cars mainly by craftsmen. Certainly no one would contradict that more skilled men, in actual numbers, were being employed now in connection with Mr. Ford's activities—taking all the ramifications mentioned—than would have been the case had he never embarked on the policy of mass production based on the elimination of skill.

What was happening was that skill which used to be applied to the production of articles of direct consumption was being eliminated and replaced by skill applied to the design and construction of the machinery and tools for making those articles; to a more refined control of the raw material out of which they were made; to the finding of markets for them; and to the control of complex organisations.

How far those tendencies would correct the balance of skill in industry, which the process of mass production seemed so seriously to upset, could not be ascertained without some far-reaching research, but it must not be forgotten that the part of the process of change which was in the limelight was just such cases as that of Mr. Ford, where the tendency was all in the one direction. The corrective tendency was going on in numberless smaller works, and from its nature was not spectacular, so that it was apt to be overlooked. He also suggested that even Mr. Ford had not reached the final stage in nearly all the possible cases. In his (Mr. Renold's) view, the proportion of skill was not, in fact, being very seriously upset. He believed that as fast as one type of skill was eliminated, other types were called into being. If that were so, the problems due to elimination of skill were personal rather than general, viz., what to do with those individuals whose particular skill was no longer wanted. To them personally the process was apt to be one of de-grading from craftsman to unskilled machine tender. That was serious enough, but presented a less dismal outlook than the view that industry would ultimately have no use for any kind of skill.

He was encouraged in that view by experience in his own works, which was an engineering factory making repetition articles, and which had been going through a process during the last fifteen years of development on the lines of "scientific management." They had carried perhaps as far as any firm in England the process of "distillation of skill" and specialisation of management functions. At three different periods he had made an analysis of the employees with reference to skill—1913, early 1927, and the present time. Tables showing the results of his analyses were exhibited. For that purpose he had used "skill" in the industrial sense, not the psychological, and had taken as a dividing line skill which required about two or three years to acquire under ordinary industrial conditions, *i.e.*, of training on the job, and not by means of whole-time intensive courses.

The striking movements, as shown by his tables were:—

(1) The growth of the craftsman category, both in numbers and in percentage of the whole.

(2) The reduction in numbers of both semi-skilled machine operators and unskilled labourers. That was due to—(*a*) The introduction of more elaborate machinery, giving greater output and requiring less "manning"; (*b*) the growing use of skilled men on such machines; (*c*) the increased use of women for unskilled work.

(3) The reduction in numbers of "upper staff" and male clerical workers, owing to the introduction of office machinery.

(4) The marked growth in the numbers of women.

Further tables showed that the proportion of "skill" of one kind or another had remained practically constant. The period of fifteen years between 1913 and 1928 had seen a revolution in manufacturing processes, clerical and statistical methods, and in organisation. All steps had been designed to replace skill by machine or to subdivide complex skills into simple ones. Yet the result was as indicated.

It might be asked, on examining his figures, whether the development of scientific management based on the elimination of skill had not been a failure, since, by his own showing, it had left the proportion of skill nearly constant. That could only be answered by an examination of the production at the three dates in question. In 1928, 1807 people, containing 34·9 per cent. of skill, produced in value nearly two and a-half times as much per individual as a group of 1256 people in 1913, which contained much the same proportion of skill, viz., 36·7 per cent. All prices in 1928 had got back to the 1913 level, but wages were substantially above the 1913 level. The increase in productivity, as measured in selling value, did not, however, quite compensate for the rise in wages. Scrutiny of his tabes suggested that the benefits of the increased efficiency had gone, in the main, to the public and the employees.

The figures seemed to support his general contention that modern developments of industrial methods required just as high a proportion of skill of one kind or another as was needed previously. In the case cited, the company produces much of its own machinery and tools, and thus gives a truer picture than a business such as Mr. Ford's, where there was no means of estimating the volume or nature of such work.

In conclusion, he said there was as much satisfaction to be derived from the exercise of skill in the sense in which he had used the term as there was from the exercise of dexterity. If the satisfaction which industry now offered were felt to be insufficient for a full life, the cause did not lie with industry, but with the greater demands on life which a more highly educated people was making.

The first paper taken on Tuesday morning, September 11th, was by Professor W. Cramp, on "The Possible Application of High-frequency Power to Electric Traction."

### High-frequency Power for Electric Traction.

Professor W. Cramp said that the idea of conveying electric power to a moving vehicle by induction, instead of by conduction, was attractive, since sliding contacts were thereby avoided. Ayrton, Perry and Mather appeared to have made an attempt in 1896 to develop a system on that principle, but, as they used ordinary power frequencies, the wattless component of current became unmanageable. In 1922 Monsieur Maurice Leblanc proposed to use a frequency of 20,000 p.p.s., and had worked out, on paper, a complete system, using an ionic high-frequency generator of his own design for the primary supply. In his secondary circuit on the train another ionic converter changed the single-phase current into three-phase low-frequency current, which fed the motors. That, arrangement involved not only a tuned primary and secondary, but also a very special form of overhead conductor and complicated gear for maintaining the tuning with change of load. The space occupied by the apparatus on the vehicle was very large, and Monsieur Leblanc did not appear to have published tests of his generator, nor to have constructed his automatic tuning gear.

In 1924 Professor Cramp saw that automatic tuning was really a natural feature of the Poulsen arc, and that in consequence a generator of that type would immensely simplify the problem. Further, a simple alternating-current to direct-current converter was already to hand in the mercury arc rectifier, if that could be used for such high frequencies. If, then, the two could be combined, transmission by induction, coupled with ordinary direct-current traction motors, became possible. For the past four years various research students had been at work at Birmingham on the parts of that combination, with the object of finding answers to the following main questions:—

(1) Can an overhead system of the type proposed act as an efficient power transformer?

(2) Can the Poulsen arc be developed into an efficient generator for these purposes?

(3) Will an arc rectifier operate at frequencies of 20,000 and upwards?

The progress of the work was reported in the paper and Professor Cramp summarised it as follows:—

(1) The efficiency of transformation is very good.

(2) The primary should be supplied with constant current at varying voltage, under which conditions the Poulsen arc operates very well. The overall efficiency can probably be made satisfactory by a suitable choice of voltage and current. Reliability and steadiness are not so certain, and more work is necessary in this direction.

(3) The arc rectifier will function quite satisfactorily even up to 107,000 p.p.s., but some further work is necessary upon the regular maintenance of the arc.

The whole combination, consisting of Poulsen arc, transformer, mercury arc and motor, has operated in

the laboratories at 75,000 p.p.s. without difficulties other than those referred to above.

Professor G. W. O. Howe said that, whilst admiring Professor Crámp's courage in putting forward his proposals, they involved so many deviations from standard traction work that most people would at first be inclined to give them the go-by and forget all about them. The very suggestion of using 20,000 or 50,000 cycles for traction work was sufficient in itself to have it turned down. At the same time past experience showed that the unpromising things in electrical engineering were likely to turn out to be very important. We had only to think of the Heaviside suggestion for improving the transmission of alternating currents over long telephone lines whilst inserting inductance in the line. At first that was thought to be so ridiculous that nobody would consider it, and it lay dormant for many years. Now it was the standard practice, and had solved the problem of long-distance telephonic communication. He was not sure that Professor Cramp was right in assuming that the collection of current on tramways by means of a rubbing contact, as at present, was such a great disadvantage. In Switzerland, where main line railways were electrified to a very great extent, rubbing contact was employed, and it seemed the least of the disadvantages of electric traction. If the overhead work could be cut out altogether that would be an enormous advance, but merely to cut out the rubbing contact seemed a small advantage to gain for so much complication. There would surely be very great difficulties with Professor Cramp's proposed method at crossings and junctions, even more than at present, because the difficulties of a tuned system appeared to him likely to be very considerable. Another point was that in the laboratory experiments the primary and secondary were the same length, but in practice the primary circuit would be many miles long and the secondary circuit presumably only the length of the coach. How would it be possible, in those circumstances, to get, as the author suggested, the added advantage of increasing the mutual inductance between the primary and the secondary? That seemed so obvious that he felt he must have misunderstood the point. Although it was stated in the paper that the tuning mechanism would be relatively simple, no details were given. At the same time he did not wish to appear too sceptical with regard to the paper. After all, the Poulsen arc was working up to 1000 kW at the Lafayette wireless station near Bordeaux and giving an efficiency of about 50 per cent., whilst the mercury rectifier was much used in traction sub-stations on the Continent, at any rate. In the new sub-stations for the Berlin railways there was no rotating machinery at all; there was a row of mercury rectifiers in which the alternating current at 50 cycles was converted into continuous current for supply to the trains. All that showed that unpromising apparatus at first could eventually prove to be extremely valuable, and he therefore hesitated to turn down what Professor Cramp had suggested. At the same time, the difficulties at the moment seemed to outweigh the advantages.

Professor E. W. Marchant said he was inclined to agree with Professor Howe that the difficulties of Professor Cramp's system outweighed the advantages at the moment and that the disadvantages of the rubbing contact had been exaggerated. One point in the practical operation was the difficulty likely to arise owing to the heavy charging currents that would be taken by an overhead system working at anything like the frequency postulated. With a system working at 50 or 60 cycles the charging current was very large, and when the frequency was increased to 20,000 the charging current would be increased 4000 times, which would be a very serious matter.

Mr. Scott Maxwell said that in 1906 he carried out experiments for the General Electric Company at Schenectady to find out the weakness of mercury rectifiers. The experiment had nothing to do with traction, but the engineers of the company were so impressed with the possibilities of the mercury rectifier in connection with the use of high-tension single-phase current on overhead lines that they immediately set to work to see if they could develop a rectifier suitable for installing on a locomotive. Mention had been made of the mercury rectifier sub-stations on the Continent, and he did not know whether Professor Howe would suggest that they could be transferred to the locomotive, but although the General Electric Company had been working at the problem since 1906 he was not aware that it had yet succeeded. The impression of the General Electric engineers was that the outlook was not very cheerful. He agreed that to eliminate only the rubbing contact in traction systems was not a big enough advantage. The real trouble with sliding contacts was with low-voltage direct current. With high-voltage single-phase current there were not the same difficulties because of the smaller currents to be handled. The suggestion that came to his mind from the paper was the possibility of having a wider air gap between the train and the conductor and so arrive at wireless traction.

Professor Cramp had not time to reply to the discussion.

### The Jet Wave.

Dr. J. Hartmann gave a paper on "The Jet Wave and its Applications." In the Hartmann jet wave a conductive liquid jet, preferably a mercury jet, passes a constant magnetic field, the lines of force of which are perpendicular to the jet. The latter touches a special electrode, which does not deform the jet appreciably. Through the electrode and the jet-producing nozzle an electric current may be transmitted into and out of the jet. The interaction between the current and the constant field will transform the jet into a so-called jet wave, the shape of which depends on the character of the current used in the production of the wave. If the current is unidirectional a simple bend is produced. The latter travels forward with the velocity of the original jet, the separate particles of the wave-bend radiating from the centre of the field along straight lines. The height of the bend thus increases proportionally with the distance from the field. On this type of wave the so-called jet wave interrupters for the operation of X-ray inductors are based. The jet is inserted in the primary circuit of the inductor and the current growing up in the circuit creates a wave as already mentioned. In travelling forward the wave hits a knife mounted between the field and the electrode, through which the current is led into the jet. The knife will cut the wave, thereby interrupting the circuit, which is not closed again until the front of a new undeflected jet has arrived at the electrode from the field. This wave may also be used as a member of simple relays and regulators.

With a simple alternating current through the jet a continuous train of regular waves is created. Approximately the waves have the shape of a sine curve with steadily increasing amplitude. On this wave the synchronous jet wave commutator is based. In the latter the wave is directed against a twin electrode consisting of two steel bars with a gap between, and a knife arranged just above the gap. Above the twin electrode is arranged an electrode—the tapping electrode—which is in unbroken contact with the wave during its motion. Thus the wave will alternately, for half a period of the current used in the production of the wave, connect the tapping electrode with the two components of the twin electrode. Thus the device may be used for rectification of any alternating voltage synchronous with the wave-producing current. It forms the main member of the jet wave rectifier, which, said the author, is presumably the first practical solution of the problem of mechanical rectification of high powers. Other applications of the jet wave are the jet wave frequency meter and the jet wave contact maker. Finally, it was pointed out that the jet wave may be used in the jet wave oscillograph for obtaining oscillograms, and this new oscillograph was claimed to have the same sensibility as a modern Duddell oscillograph.

*(To be continued.)*

## Letters to the Editor.

*(We do not hold ourselves responsible for the opinions of our correspondents.)*

### BREAKDOWN EQUIPMENT.

SIR,—I am sorry for the delay in answering your correspondents on above subject (away from home).

I am so pleased that my remarks on this question have interested the writer of the article and others who may have this work.

Mr. Sams says "he is sceptical of the alleged method of re-railing engines." Let us be clear on this matter. I said when the engine was off the rails, tender on, or *vice versâ*. I am not surprised at Mr. Sams or the writer of the article doubting my statement. It has been truly said, "necessity is the mother of invention."

I will now tell how it occurred to me. About twenty-four years ago I was sent for to turn out all speed, engine derailed; this on a Saturday night; men could not be got. Cranemen, I and a couple of cleaner boys to face this job. When we get to the engine, I see engine off, tender on, head the wrong way to get the use of the uncoupling key and rope, as she was so close to the wall of, or near, Hyde Park Works, now the N. B. Loco. Company, Glasgow. Problem. Engine must be re-railed. I arranged with the cranemen that I would try to scotch tender up. A couple of jacks on the back beam of the engine; crane lifts engine till driving wheels are 2in. or 3in. above rail level. I placed a 15-ton jack to push the trailing wheels over till I could get a grip with the flanges, lowered the beam jacks till the wheels touched the rail, then slewed the crane to suit, "and it was done."

The engine I refer to was a six-coupled goods of 36 or 40 tons.

Now I have said in some detail when it was first done, and in a measure how and where it was done, has been done all these years, and is being done now. I have advised many in other districts to try it. The writer of the article says, he always thought it impossible to swing engines on the crane with jacks on the other end. Mr. Sams says he does not see how the rear end will stay on the jacks. The word "impossible" must be deleted from the vocabulary of a supervisor at a breakdown.

Perhaps a fuller explanation will help. Engine off, scotch the tender in four wheels at least, back and front. Put jacks on the rail if possible, if not on hard blocks, height to suit; place a piece of ¼in. by 1in. or 1¼in. across the top of the jacks, lift the jacks until the tender is being raised by the drawbar, and then in conjunction with the crane, you will gain confidence; if you place the jacks slightly to the wrong side, with the tension of the drawbar, you will obtain the 3in. or 4in. on the length of a standard jack for slewing. I have never seen it fail. I very seldom required the push jack after gaining experience. Always try and get a rock on the foot and the head of the jacks, that is why I prefer the rail and a piece of packing. As a rule, for this job, corner blocks at the front or back of the crane will be enough. As for self-propelling cranes, I would not like to be dogmatic, as I never had anything to do with them, but I have never seen much need, because we had always the train engine at hand.

September 12th. ALEX. MORRISON.

### THE RECOVERY OF WASTE HEAT.

SIR,—The three letters which appeared in your issue of August 31st show how important a point you raised in your editorial article on the recovery of waste heat. Everybody knows the good work done by Messrs. Joseph Adamson and Messrs. Spencer Bonecourt in the development of waste heat boilers, but they write as specialists, and perhaps I might say as interested specialists, and therefore do not take so wide a view of the question as is desirable for the benefit of the steel trade. There is no need to doubt Messrs. Adamson's statement that their customers have not found any difficulty in using the "free" steam provided by waste-heat boilers. Most of them "use" the steam by throwing half of its heat value away, as is shown by Mr. Hider's remark as to the many thousands of pounds of exhaust steam being blown into the air every hour from the exhausts of rolling mill engines. Even a reciprocating engine exhausting at atmospheric pressure is consuming about double the steam which would develop the same power in a turbine, and a reversing rolling mill engine is about the worst "steam-eater" ever invented. To put down waste-heat boilers for the purpose of making steam to be disposed of, I cannot say used, in this way is questionable economy. I note that two of your correspondent's both refer to the British practice of using steam driven rolling mill engines. Can they tell me whether there is any connection between this practice and the fact that British production costs are so high that about half our steel supplies are imported from the Continent? If the advocates of waste-heat boilers and steam-driven rolling mills really wish to render a service to the steel industry, they would do well to reduce their claims to figures, and give comparative estimates of capital, running and maintenance charges for the plant they would propose and for a modern highly regenerative furnace plant with electrically-driven mills. Then we should have something to argue about.

May I, in conclusion, protest against the penultimate paragraph of Messrs. Adamson's letter. Your article served to present to English engineers, in a concise form, the views of the chief engineer of what is, I believe, the largest steel making company in the world on the subject of waste-heat boilers. Far from being a discouragement to those who are striving for engineering progress, it was of a stimulating and suggestive article, worthy of courteous and detailed criticism by those who might disagree with the views expressed. I take it that you were "urging steelmakers to spend money now on the best equipment," and endeavouring at the same time to aid them in their choice by calling attention to aspects of the question too often disregarded by those who only see one way of solving a complicated problem. M. I. MECH. E.

September 6th.

### STEAM PIPE JOINTS A CENTURY AGO.

SIR,—Being interested in the production of a real facsimile of an ancient engine, I am desirous of knowing how steam joints were made a hundred years ago. I have examined quite a number of contemporary books, but with the exception of Tredgold on "The Steam Engine," 1827, they make no reference to this detail. Tredgold speaks of the use of the rust joint and gives the recipe for a composition, and he also mentions in a line or two the use of a "flexible" and "endurable" packing material. The latter interests me most, as a solid rust joint could hardly have been used in the engine I have in mind. It seems to me probable that hemp rings well impregnated with red lead were employed. Can any of your readers tell me? Though none of them can go back a hundred years, some of them may have used steam pipe packings of a traditional kind much later and may be in a position to give some information that will help me. If they can, they will benefit all who take an interest in the history of technology, and not least

September 19th. YOUR HUMBLE SERVANT.

---

THE University of Sheffield has tested two models of Sullivan electric coal-cutting machines in order to demonstrate their safety when used in fiery pits. In the course of tests the coal-cutters were filled with a highly-explosive mixture of fire-damp and air; this was ignited inside the machine by a spark from an induction coil, while the machine was surrounded by a similarly dangerous atmosphere. Explosion pressures occurring inside of the machine were recorded at four points. The firm's latest model "12in." coal-cutter was in this way submitted to nineteen separate tests, varying the point of ignition, some with the motor running and others with it stationary. In no instance was the gas surrounding the machine ignited by internal explosions of great violence. The University has granted the makers permission to affix a brass plate to all classes to show that these machines are of an approved flame-proof design. Some of the firm's compressed-air coal-cutters were submitted to other equally severe tests, but, of course, of an entirely different nature.

## Railway Matters.

IN this column of our issue of July 20th mention was made of the future of the small railways in Spain. It is now officially announced that the Madrid, Cáceres and Portugal and Western of Spain Railway has been taken over by the State. It is 777 kiloms. in length, and of the standard Spanish gauge of 5·47ft.

UNDER the new winter timing operative from Monday next, the 24th, the Cornish Riviera Express and the Torbay Express, both of which will call at Exeter, will cover the 164½ miles between Southall and Exeter at an average speed of 60·4 miles per hour. This is believed to be the fastest rate in the world, continued, without break, over so great a distance.

"LYING-DOWN" accommodation will be available as from Monday next, the 24th, for third-class passengers on night trains from Euston to Aberdeen, Inverness, Edinburgh, Glasgow, Stranraer, and Holyhead; from St. Pancras to Edinburgh and Glasgow; from King's Cross to Aberdeen, Edinburgh, Glasgow, and Newcastle; from Paddington to Penzance. There will be similar accommodation on the corresponding up trains.

CRUMLIN VIADUCT, which carries the Newport, Abergavenny and Hereford branch of the Great Western Railway over the Western Valleys line, is being strengthened. As related in Part XVI. of "One Hundred Years of British Railways," in THE ENGINEER of October 17th, 1924, it is 1500ft. long, with a greatest height of 200ft., and an average height of 138ft., has ten spans of Warren truss girders, cost £39,000, and was opened on June 1st, 1857.

THE coroner's inquest into the death of the two passengers killed in the collision of July 9th at London Bridge was opened on the 13th of that month, and was then adjourned until Monday last, September 17th. On its resumption the driver of the light engine said that he received a "clear" signal to leave the siding, and afterwards saw one at "danger." That signal he passed in that condition, but could not explain why. Seeing then a "clear" signal ahead of him he continued on his way. The latter signal though was by the outgoing passenger train, into which the light engine ran. The jury returned a verdict of "Accidental Death."

AN objection that has been raised in India—and, on occasion, in this country—against the adoption of a central buffer for railway wagons is that the underframes are constructed for side buffers. Trials made by the Indian Railway Conference Association, in connection with the proposed adoption of a centre buffer coupling, show, however, that the necessary strengthening can be carried out in standard wagons at a reasonable cost, and that vehicles so altered are capable of withstanding the severe shocks which may be expected under service conditions. That may not be the case with older wagons, and the question of strengthening them is still under investigation. When it has been decided what will be necessary, it is proposed again to review the financial aspect of the change over from side buffers to central buffer couplings. Meanwhile, it has been arranged that all new locomotives and rolling stock in India shall be fitted with a yoke type of draught gear which will make conversion to be effected by merely replacing the temporary draw hook with an automatic central buffer coupling.

AN interesting piece of minor railway history is revived by the announcement that the railway companies have been approached by a firm of advertising contractors with a view to using the sides of railway wagons for advertisements. Before grouping, several railway companies enjoyed the advantage that initials of their names were expressed in two letters—thus, G.W., G.N., G.E., G.C., L.Y., N.E., N.B., &c.—which letters were placed on either side of the middle door of wagons. The Midland Railway was the first to do that. In 1875 it was announced that the company proposed to purchase the 40,000 privately owned wagons running on that system. In 1882, 6384 wagons were bought, and by August, 1885, the company had purchased 41,862. The trucks, when purchased, were at first lettered "Midland Railway Coal Wagon," but when the number increased that was too long a task, so they were painted a slate colour and lettered only "M.R." The result was so effective and proved such an excellent advertisement that other companies followed suit. To complete this little story, it may be added that the purchase of privately owned wagons was subsequently abandoned, as there was nothing to prevent a new owner entering the field.

THE derailment of the whole of an express train—tank engine, five bogie coaches and a horse box—on February 27th last at Chatburn on the Blackburn–Hellifield section of the London, Midland and Scottish Railway, was, according to the recently issued report of Lieut.-Colonel Mount, due, in part, to the track not being equal to a speed of more than 35 or 40 miles per hour—the train was running at 55 miles per hour—but, mainly, to the failure of the right-hand trailing coupled spring of the engine. Of the fourteen plates in that spring, fatigue cracks of varying size existed in seven plates, and possibly in one other, at or near the nibs and on the top or tension side; the top two and the bottom three plates were found to be broken after the accident, whilst the tenth plate was so brittle that it broke during transit of the loose pieces for examination. Five of the fourteen plates in the corresponding spring of the left trailing coupled wheel were also defective. Criticism was also passed on the fact that after a hot box on the left trailing coupled wheel, the engine was weighed on December 15th, but that course was not adopted after it had been derailed owing to a broken rail in a siding on January 27th. Then, for reasons which could not be explained, the right driving spring was changed on February 10th. Colonel Mount remarks that probably there is no part of a locomotive which presents more difficulty than the spring, not only in respect of its material, but also of its design and manufacture, and the matter, he has been informed, has been, and still is, receiving very close attention by chief mechanical engineers, particularly with regard to the material, methods of manufacture, tempering, &c., to obtain the most economical and satisfactory results.

## Notes and Memoranda.

THE building of a huge steel bridge over the Saskatchewan River is proposed by the Canadian Pacific Railway. It will be 1840ft. long, with an approximate height of 150ft., while there will be fifteen spans.

BROADCAST radio-telephone receiving licences current in Great Britain at the end of June, 1928, numbered 2,511,736, an increase of 5477 during the month of June. The following interesting figures, issued by the Bureau Internationale de Radiophonie at Geneva, says the *Wireless World*, are an indication of the approximate number of licensed listeners in some of the countries of Europe:—Austria, 293,408; Denmark, 214,734; Hungary, 98,011; Lithuania, 9407; Norway, 64,722; Switzerland, 66,731; Sweden, 357,828; Czecho-Slovakia, 225 501.

ON the occasion of the fiftieth anniversary of the adoption of the Koepe system of winding coal, Professor Dr. Fritz Schmidt, of Berlin, contributes an article to a recent issue of *Glückauf*, in which, after paying homage to the inventor of the system, who died in 1922, the disadvantages of engines with drums are discussed, more especially when winding from very deep shafts. He publishes statistics showing the steady increase in numbers of Koepe winders in five German districts, and finally points out the directions in which further research should seek to improve the system.

THERE has been considerable growth in the popularity of aluminium sulphate as an ingredient for orchard spray materials by Nova Scotian agriculturists. According to the *Chemical Trade Journal and Chemical Engineer*, it is said that the beneficial action of aluminium sulphate is similar to that of lime sulphur, while the objectionable characteristics of the latter are largely eliminated. Experts predict that the future consumption will expand. The aluminium sulphate is mixed with other spray ingredients, such as lime sulphur, calcium arsenate and nicotine. The exceptional demand during the current season created a temporary shortage of supply. Aluminium sulphate is obtained from Montreal, the United States, and Great Britain.

THE value of electric welding on structural steel work where it is essential to minimise noise was well illustrated recently by the Forest City Structural Steel Company, Cleveland, in the erection of the steel for an addition to the Glennville Exchange of the Ohio Bell Telephone Company. The new addition was framed into the partition running along the exchange room where the telephone operators work. It was necessary for the exchange to continue in operation continuously, although the work was being done during a blizzard. The new steel work was framed into the housing columns without tearing away the partition into the exchange room. All work was done by welding at this point, eliminating all noise and dirt, in addition to obviating the necessity of cutting large holes in the partition and letting the weather in.

IN conjunction with the General Post Office, the British Broadcasting Corporation has concluded some preliminary technical experiments in the wireless transmission of still pictures. As a result arrangements have been made for a short picture transmission daily from Daventry (5XX) outside regular programme hours. These transmissions will begin in October. The material of each transmission will consist of a selection from several subjects. If and when it is discovered that there is a sufficient public demand for still pictures radiated in this way, transmissions will be included in regular programme hours. The Fultograph system will be used for the series of transmissions beginning in October. The British Broadcasting Corporation points out that methods of transmitting and receiving pictures such as the Fultograph should not be confused with what is commonly known as "television."

A REVIEW of the progress in the production of steel castings in the United States during 1927 emphasises the increasing realisation of the value of heat-treated alloy steel castings for a variety of purposes. A wide range of mechanical properties may be obtained by the suitable adjustment of the alloy elements, nickel, manganese, vanadium and chromium. High-manganese steel castings have a useful field of application where high resistance to abrasion and great toughness are required, but it has the disadvantage that it tends to flow under continuous heavy pressure. For parts working under conditions which involve heavy steam or liquid pressures some of the low nickel-manganese steels are found to be eminently satisfactory, and they are also easier and cheaper to manufacture than the high-manganese steels. Low-alloy steel castings of this type are also being used in a number of cases to replace forgings of intricate design. The remarkable resistance to heat and corrosion shown by the high-alloy nickel-chromium steel castings is leading to a rapidly increasing demand for this type of material for use under extreme conditions.

ATTENTION is directed in a recent issue of *Nature* to a new German patented process for producing tungsten filaments for incandescent lamps, which are capable of producing much more intense illumination than has hitherto been possible. The process depends upon the formation of long single crystals of the metal, which differ considerably in properties from the ordinary polycrystalline variety. They are not disintegrated at high temperatures like ordinary filaments and consequently they do not blacken the inner surface of the container. The preparation of such long or single crystals in the form of threads was described in 1926, and many attempts have been made to utilise this material in the form of coils for incandescent lamps. Hitherto these attempts have been unsuccessful, owing to the tendency of the bent single crystal to revert to the polycrystalline condition during the burning of the lamp. This tendency, which appears to be due to the mechanical strain involved in wrapping or coiling the filament, has apparently been successfully overcome at the Technische Hochschule in Dresden, and it has been found possible to construct 5-kW and 10-kW lamps with an average intensity of 8000 candle-power, although a maximum intensity of 60,000 candle-power is said to have been attained. The lamps have a life of 800 burning hours, and a company has been formed in Dresden for the purpose of manufacturing them. They are likely to replace arc lights for many purposes in industry.

## Miscellanea.

ACCORDING to revised figures issued by the Dominion Bureau of Statistics at Ottawa, the Canadian nickel-copper industry last year produced 1,305,917 tons of ore containing 27,564 tons of copper and 43,571 tons of nickel. The smelters treated 1,350,214 tons of ore and concentrates, and produced 81,488 tons of matte, which contained 51,937,215 lb. of copper and 79,246,144 lb. of nickel.

SOME years ago the Electrolytic Zinc Company, of Australasia, Ltd., erected a pilot plant at Risdon, Tasmania, for the manufacture of lithopone. It is now reported that the company has decided to increase the size of the existing plant or to arrange that an associated interest in New South Wales will purchase the full output of zinc dross produced at Risdon and utilise it for the manufacture of lithopone on a scale of about 3000 tons annually.

THE contract for the construction of a 750,000-dollar sewage system in the Bahama Islands has been awarded to the McNamara Construction Company of Toronto, Ont. The work will consist of buildings for pump-houses and sludge plant, an outfall sewer from Nassau to Key Island, and 16 miles of sewer. Work will start as soon as the necessary plant can be placed on the job. The McNamara company has just completed construction of a dock bridge and other work for the Government of the Bahamas.

OWING to the steady growth of the Institute of Fuel, and the desirability of providing additional amenities for the benefit of members, the Council has taken more commodious offices on the second floor of 53, Victoria-street. The postal address and telephone number will remain unchanged. The offices will be occupied by the Institute on Monday, September 24th next, and will include, in addition to a general office and library, a reception and reading room available for use of members during office hours.

ANNOUNCEMENT is made of the award of a contract to the Canadian Vickers Company, Montreal, for the building of a new 17-knot cruiser to be used in Customs prevention service in the Atlantic division. The successful tender was 229,160 dollars, and was the lowest submitted, officials state. The new vessel, which is required to be delivered at Halifax within nine months, will be 165ft. long and will be powered by three 500 H.P. oil-burning engines. It will be used for patrol purposes, particularly to deal with rum-running. There were six tenders received, four being from Canadian firms.

A DECREE has been issued giving the Spanish Government control over the prices of olive oil in order to prevent an inordinate rise. So far, the market has not weakened as a result of this measure; even in Andalusia, where the stocks are the largest, holders refuse to put more oil on the market than is necessary for daily consumption. Manufacturers of tinned foods asked for permission to use groundnut oil for their goods destined for export, instead of olive oil, and the importation has been authorised of 5000 tons of groundnut oil exclusively for the manufacture of certain preserved foods for export.

ACCORDING to the monthly report of the National Federation of Iron and Steel Manufacturers, the number of furnaces in blast at the end of August was 130, a net decrease of one since the beginning of the month. The production of pig iron amounted to 519,000 tons compared with 537,800 tons in July and 596,100 tons in August, 1927. The production included 164,700 tons of hematite, 193,400 tons of basic, 121,300 tons of foundry and 25,200 tons of forge pig iron. Production of steel ingots and castings in August amounted to 648,300 tons, compared with 666,900 tons in July and 643,100 tons in August, 1927.

REPRESENTATIVES of the U.S. Geological Survey are *en route* to Panama to conduct foundation investigations in connection with the Alhajuela dam project in Panama. The proposed dam is to be 150ft. high and will provide additional storage and hydro-electric power for use in connection with the operation of the Panama Canal. Actual work is expected to start this autumn. With the increase of traffic through the Canal, it has become necessary to provide against an unusually prolonged dry season. It has practically been decided to abandon the idea of constructing a railway to the dam site. It is believed that the materials can be handled to advantage by truck. The 14 miles of highway which will have to be constructed will form a link in the inter-oceanic road.

WE hear that the question of a site for the new Swansea super-power station is still undecided. The proposal to reclaim a portion of the foreshore is not likely to be pursued, owing to considerations of cost and length of time required. The site most favoured now is one at Port Tennant, where trial bores have been made to ascertain the nature of the soil and foundations. This site would avoid the cooling water problem, as the water of the Queen's Dock would be available in accordance with a tentative agreement with the Great Western Railway Company. It is believed that the adoption of this site would expedite the transfer of the existing station and enable the North Dock, from which that station derives its cooling water, to be filled in. The new generating station is estimated to require an outlay of over £1,000,000.

IN spite of the somewhat difficult position with respect to trade with Russia, it seems that electrical firms at any rate, have found the means of keeping the trade door at least ajar if nothing else. According to the *Electrician*, orders for electrical equipment to the value of £11,402 were placed in Great Britain by the U.S.S.R. during the April–June period, while goods actually shipped to Russia from this country amounted in value to £3441. Though the majority of orders from the Soviet are for machinery of the hydro-electric type, there are nevertheless a considerable number of domestic electrical appliances finding their way into the country. Germany, of course, also shares the Russian market, but preference appears to be given to British-made machinery. When the difficult position which exists, both politically and commercially, between the two countries is taken into account, it is something of a compliment to the electrical industry as a whole that British manufacturers are able to value Russian patronage at over £10,000 when the neighbouring country of Germany has so much in her favour.

# MACHINE TOOLS AT THE OLYMPIA EXHIBITION

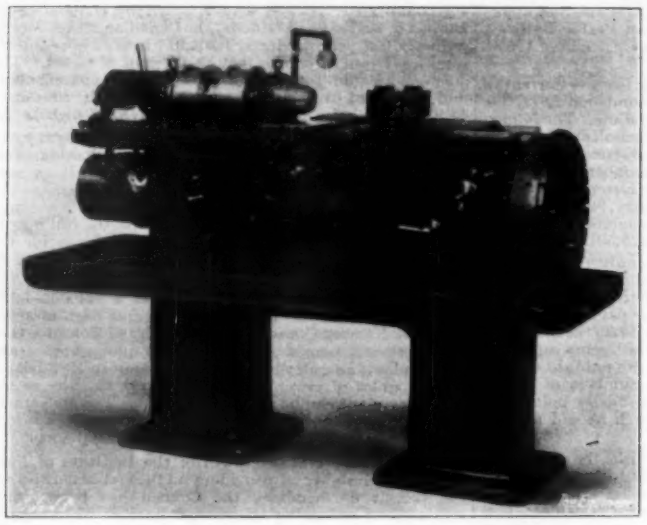


FIG. 63—AUTOMATIC SCREWING MACHINE—BUTTERWORTH

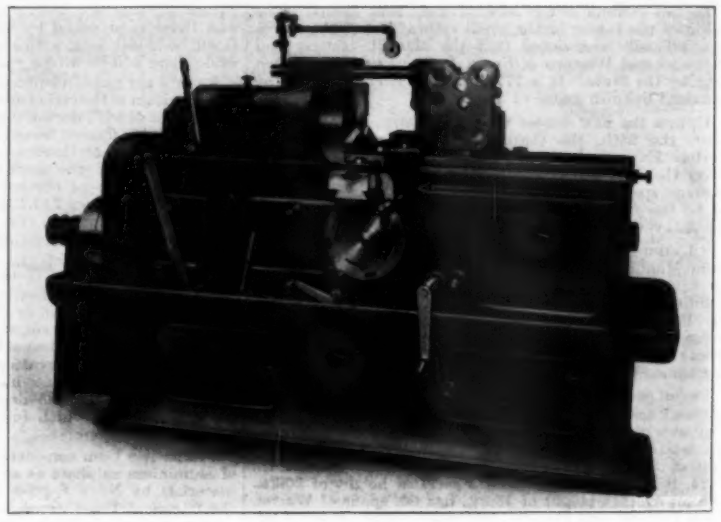
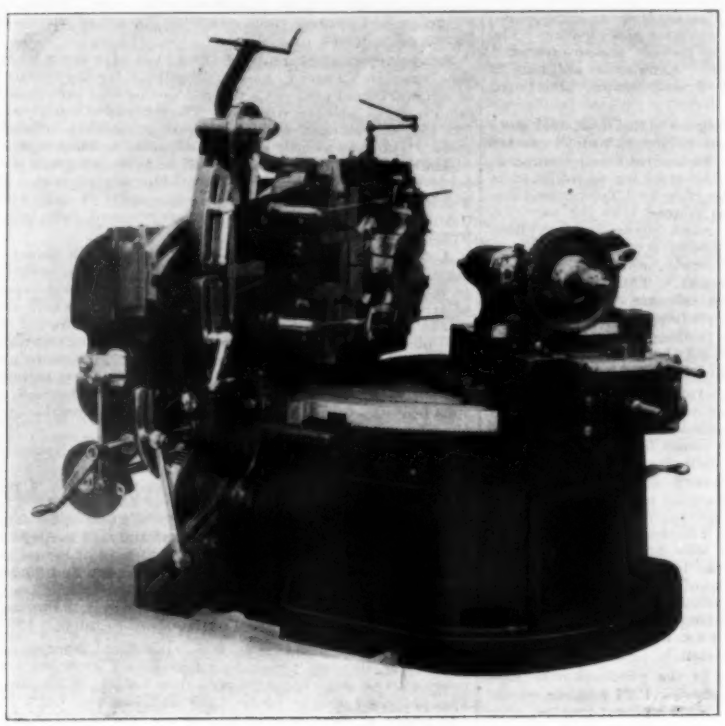
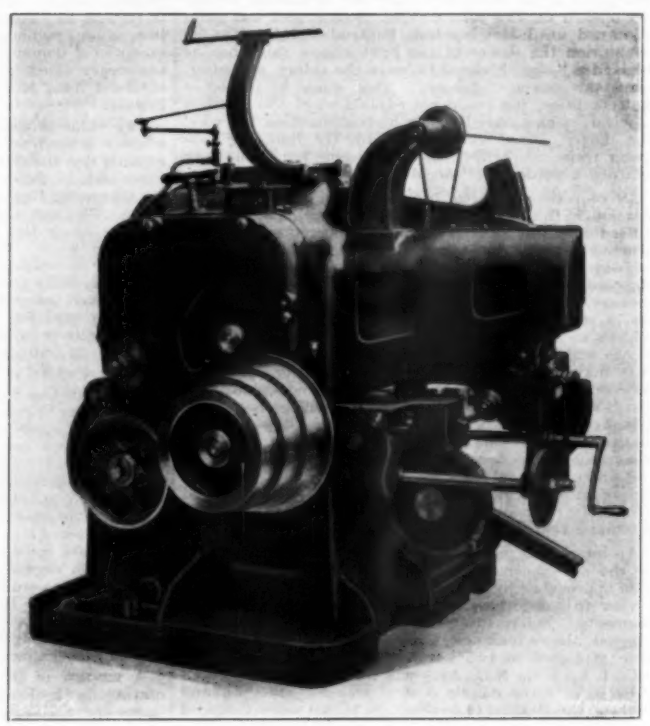
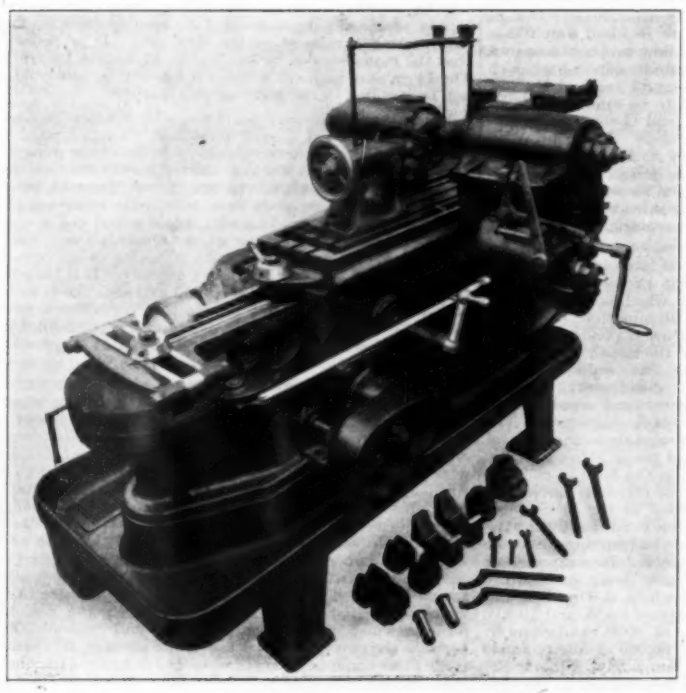


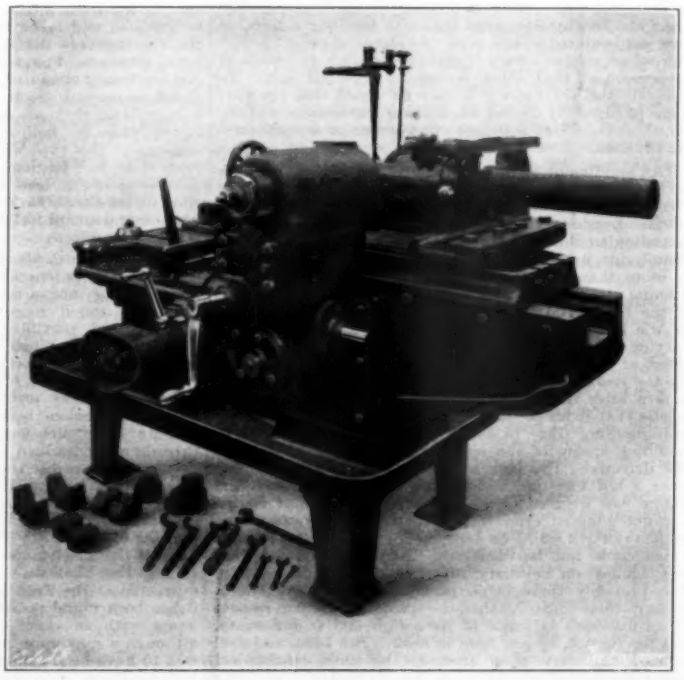
FIG. 64—AUTOMATIC CHUCKING MACHINE—BUTTERWORTH





FIGS. 65 AND 66—SPIRAL BEVEL-GEAR PLANER—SMITH AND COVENTRY





FIGS. 67 AND 68—KEY-SEATING MACHINE—SMITH AND COVENTRY

# The Engineer
## Annual Subscription Rates

**(including postal charges).**

Subscriptions will be accepted by the Publisher direct or through a newsagent at the rates and in the currencies stated below :—

| | | | | |
|---|---|---|---|---|
| **BRITISH ISLES** | £3 | 5 | 0 | |
| **CANADA** | £3 | 3 | 0 | Thick Paper edition. |
| | £2 | 18 | 6 | Thin Paper edition. |
| **ABROAD** | £3 | 7 | 6 | Thick Paper edition |
| (except Canada) | £3 | 3 | 0 | Thin Paper edition. |

| | | |
|---|---|---|
| AFRICA | Central News Agency. All Branches | |
| * £3 7s. 6d. | CAPE TOWN : Wm. Dawson and Sons, Ltd., | |
| † £3 3s. 0d. | 29–31, Long-street (Box 489) | |
| | JOHANNESBURG : C. Juta and Co. | |
| ARGENTINA | BUENOS AIRES : Mitchell's Book Store, 576, | |
| * £3 7s. 6d. | Cangallo | |
| † £3 3s. 0d. | | |
| AUSTRALIA | Gordon and Gotch (Australasia), Ltd. All | |
| * £3 7s. 6d. | Branches | |
| † £3 3s. 0d. | MELBOURNE : Robertson and Mullens, | |
| | Elizabeth-street | |
| BELGIUM | BRUXELLES : W. H. Smith and Son, 78–80, | |
| * Fr. 590 | Rue du Marché-aux-Herbes | |
| † Fr. 550 | | |
| CANADA | American News Company, Ltd. All Branches | |
| * $15·25 | MONTREAL : Gordon and Gotch, Ltd., 334, | |
| † $14·25 | Notre Dame-street, W. | |
| | TORONTO : Wm. Dawson and Sons, Ltd., 87, | |
| | Queen-street East | |
| | TORONTO : Gordon and Gotch, Ltd., 81, | |
| | Queen-street, West. | |
| CEYLON | COLOMBO : Wijeyartna and Co. | |
| * Rs. 44·5 | | |
| † Rs. 41·5 | | |
| CHINA | HONG KONG : Kelly and Walsh, Ltd. | |
| * $37 | SHANGHAI : Kelly and Walsh, Ltd. | |
| † $34·5 | | |
| EGYPT | CAIRO : Express Book and Stationery Store, | |
| * £3 7s. 6d. (Pt. 330) | 9, Chareh Maghrabi | |
| † £3 3s. 0d. (Pt. 308) | | |
| FINLAND | HELSINGFORS : Akademiska Bokhandeln, | |
| * M. 650 | Alexandersgatan, 7 | |
| † M. 605 | | |
| FRANCE | PARIS : Boyveau and Chevillet, Rue de la | |
| * Fr. 418 | Banque, 22 | |
| † Fr. 390 | PARIS : Berger Leverault, 229, Bld. St. | |
| | Germain | |
| | PARIS : Brentano's, 37, Av. de l'Opera | |
| | PARIS : Dunod, 92, Rue Bonaparte | |
| GERMANY | BERLIN : H. Hermanns, Friedrichstrasse 218, | |
| * R. mks. 70·00 | S.W. 48 | |
| † R. mks. 65·00 | WESTERN GERMANY : Fritz Rehfus, Blumen- | |
| | thalstrasse 10, Cologne | |
| | LEIPZIG : K. W. Hiersemann, Konigstrasse 29 | |
| HOLLAND | ROTTERDAM : Hector's Boekhandel, Noord- | |
| * Fl. 41·00 | blaak 59 | |
| † Fl. 38·00 | ROTTERDAM : Techn. Boekhandel, "Plan C" | |
| | Gelderschestraat 4 | |
| INDIA | BOMBAY : Thacker and Co., Ltd. | |
| * Rs. 45 | CALCUTTA : Thacker, Spink and Co. | |
| † Rs. 42 | | |
| ITALY | MILAN : Ulrico Hoepli | |
| * Lire 300 | ROME : Maglioni and Strini, 307, Corso | |
| † Lire 280 | ROME : Fratelli Treves, Corso Umberto 1, 174 | |
| | ROME : Fratelli Bocca | |
| JAPAN | Maruzen Co., all Branches | |
| * £3 7s. 6d. | | |
| † £3 3s. 0d. | | |
| JAMAICA | KINGSTON : Educational Supply Co. | |
| * £3 7s. 6d. | | |
| † £3 3s. 0d. | | |
| NEW ZEALAND | AUCKLAND : Whitcombe and Tombs, Ltd. | |
| * £3 7s. 6d. | Gordon and Gotch, Ltd. All Branches | |
| † £3 3s. 0d. | NAPIER : J. Wilson Craig and Co. | |
| RUSSIA | LENINGRAD : Mezhdunarodnaya Kniga, Pros- | |
| * £3 7s. 6d. | pect Volodarsky, 53 A | |
| † £3 3s. 0d. | MOSCOW : "Litisdat," Kousnetsky Most, 5–15 | |
| STRAITS SETTLEMENTS | SINGAPORE : Kelly and Walsh, | |
| * $29·25 | Ltd. | |
| † $27·25 | | |
| SWEDEN | STOCKHOLM : A/B Wennergrens Journal- | |
| * Kr. 61·00 | expedition, Stockholm 1 | |
| † Kr. 57·00 | STOCKHOLM : A/B C. E. Fritzes Kungl., | |
| | Hofbokhandel, Fredsgatan, 2 | |
| SWITZERLAND | BERNE : Joh. William De Groot, Laupenstr. 5 | |
| * Fr. 85·20 | ZURICH : Rosa Leibowicz, 4, Ankerstr. | |
| † Fr. 79·50 | | |
| UNITED STATES OF AMERICA | International News Co., 131, Varick-street, New York, N.Y., and all Branches | |
| * $16·40 | Entered as second-class matter at the Post Office, | |
| † $15·25 | New York, N.Y., December 12th, 1896, under the Act of March 3rd, 1879 (Section 397, P.L. & R.) | |

* *Thick Paper.* † *Thin Paper.*

*These rates are liable to alteration if exchange fluctuations require it.*

*** READING CASES, *to hold two copies of* THE ENGINEER, *cloth sides and leather backs, can now be supplied at 4s. 9d. each, 5s. 3d. post free.*

### "THE METALLURGIST."

This Supplement, which deals with the Science of Metallurgy, both ferrous and non-ferrous, is published free with the last issue of THE ENGINEER in each calendar month.

### ADVERTISEMENTS.

**The charge for Classified Advertisements is 1/- per line up to one inch – minimum charge 6/-; those occupying one inch or more at the rate of 12/- per inch. Orders must be accompanied by a remittance. The rates for Displayed Advertisements will be forwarded on application. Classified Advertisements cannot be inserted unless delivered before TWO o'clock on Thursday afternoon (the day before publication).**

*Letters relating to the Advertisement and Publishing Department of the Paper are to be addressed to the Publisher, all other letters are to be addressed to the Editor of* THE ENGINEER.

### THE ENGINEER DIRECTORY.

This Directory, which is published annually in the interests of advertisers in THE ENGINEER, may be obtained free of charge on application to the Publisher.

**Postal Address, 33, Norfolk-street, Strand, W.C. 2.**
**Teleg. Address, "Engineer Newspaper, Estrand, London."**
**Telephone Nos. Central 2256, 2257.**

***By arrangement with Reuter's Engineering Service, The Engineer contains the latest news from all parts of the world which is likely to be of interest to engineers.***


## Contents.


THE ENGINEER, September 21st, 1928. PAGE

| | |
|---|---|
| A SEVEN-DAY JOURNAL | 305 |
| MACHINE TOOL EXHIBITION, OLYMPIA. No. III. (Illus.) | 306 |
| MECHANICALLY-OPERATED GARAGE | 312 |
| THE BRITISH ASSOCIATION | 313 |
| LETTERS TO THE EDITOR— | |
| Breakdown Equipment | 316 |
| The Recovery of Waste Heat | 316 |
| Steam Pipes a Century Ago | 316 |
| RAILWAY MATTERS | 317 |
| NOTES AND MEMORANDA | 317 |
| MISCELLANEA | 317 |
| LEADING ARTICLES— | |
| Machine Tools | 319 |
| Tank Engines and the Track | 320 |
| THE BRAND SYSTEM OF BURNING PULVERISED COAL. (Illus.) | 321 |
| RAILWAY BREAKDOWN CRANES. (Illus.) | 322 |
| STANDARDISATION—ITS ECONOMIC BASIS | 323 |
| BOOKS RECEIVED | 324 |
| A 935 B.H.P. AIRLESS-INJECTION OIL ENGINE. (Illus.) | 324 |
| THE CONTROL OF THE GUADALQUIVIR | 325 |
| SIXTY YEARS AGO | 325 |
| THIRD-CLASS SLEEPING CARS | 325 |
| THE MODEL ENGINEER EXHIBITION | 325 |
| BRITISH AND AFRICAN MOTOR TRADE | 325 |
| THE TURBO-ELECTRICALLY PROPELLED P. AND O. LINER VICEROY OF INDIA. (Illus.) | 326 |
| INSTITUTE OF MARINE ENGINEERS (PRESIDENTIAL ADDRESS) | 326 |
| AMERICAN ENGINEERING NEWS | 327 |
| PROVINCIAL LETTERS— | |
| The Midlands and Staffordshire | 327 |
| Lancashire | 328 |
| Sheffield | 328 |
| North of England | 328 |
| Scotland | 329 |
| Wales and Adjoining Counties | 329 |
| PERSONAL AND BUSINESS ANNOUNCEMENTS | 329 |
| CONTRACTS | 329 |
| LAUNCHES AND TRIAL TRIPS | 329 |
| CURRENT PRICES FOR METALS AND FUELS | 330 |
| FRENCH ENGINEERING NOTES | 331 |
| BRITISH PATENT SPECIFICATIONS. (Illus.) | 331 |
| FORTHCOMING ENGAGEMENTS | 332 |


### NOTICES TO READERS.

*** *If any Subscriber abroad should receive* THE ENGINEER *in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

*** *All letters intended for insertion in* THE ENGINEER *or containing questions shou d be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *No undertaking can be given to return drawings or manuscripts; correspondents are therefore requested to keep copies.*

# THE ENGINEER.

*SEPTEMBER* 21, 1928.

### Machine Tools.

No one who has visited the Machine Tool Exhibition which closes to-morrow can have failed to be impressed by the general excellence of the machines exhibited. There is not one that does not show in its design and construction the hand of the real engineer, and there is a complete absence of that type which seemed to be, and often, in fact, was, the product of traditions handed down by patternmakers and fitters. The only traditional features which machine tools now retain are to be seen in those fundamental details which no desire for change or call for modification can remove. Machine tool design has definitely passed out of the stage when anyone could make a lathe or a slotting machine, and has passed into the hands of men who have made as close a study of all the problems involved as the engineer does of a turbine or the electrician of a dynamo. We may remember with pride and gratitude the great men —the Wilkinsons, Maudslays, Whitworths—who laid the foundations of the British machine tool trade, but we must, in all fairness, accord to men of the present generation, who have modified the old designs almost out of all knowledge, all honour for the remarkable work they have achieved in the elevation of primary and elemental types into the vastly improved machines which we have to-day. It would be invidious to mention names, but at least we may claim that the British machine tool of to-day is as fine a product of engineering skill and as fine an adaptation to the requirements of the factory as any country in the world can show To the pioneers in this field we owe an incalculable debt. The machine tool was once the servant of the machine shop; it is now the master. It is the machine tool maker who tells the manufacturer how work is to be done; no longer the manufacturer who prescribes the machine tool. Employers are bound to watch every advance in machine tool design; they are bound to go to exhibitions, such as that at Olympia, to see what new developments the makers have to offer, and, if they are wise, they are bound to let the machine tool maker into their factories, so that he may study the nature of the work upon the spot, and be in a position to make advances which will accelerate and cheapen output. It is this direct knowledge of workshop requirements that has led more than anything else to the marked improvements in the facility of handling which is one of the outstanding characteristics of modern tools.

When machine tool design and construction is advancing as rapidly as at present, it is not unnatural to ask, What of the future? What notable development may we expect? The first, no doubt, is the increase of feed and speed as the result of further progress in the art of making cutting tools. We may expect, too, with reasonable certainty to see an extension of heavy grinding, and the disappearance of the countershaft is foreshadowed by the extension of individual motor drives. But there are, so far, no indications that any totally new form of machine tool, a new method of removing metal, if we except autogenous cutting, is almost in sight. It seems that for years to come machine tools will retain substantially the same forms which they have now. But details will change and we have heard it said that in ten years' time the hydraulic feed will be very widely employed. Its development is a subject of great interest. The hydraulic operation of cutting tools, lathes particularly, is no new thing. It dates back long before the war; but it will be recalled that during the war one shell factory—that of Spencers, of Melksham—was fitted throughout with hydraulically manipulated tools, and did wonders in the speed of output. It demonstrated in a remarkable way the peculiar and valuable properties of hydraulic operation, and we would advise anybody who desires to follow up this fascinating subject to turn to the description of the works which was given in the second volume of the Ministry of Munitions *Journal*. It is a fact of common knowledge that inventions hang upon each other; that obvious progress in a certain direction is frequently barred by the lack of the means for pursuing it. The probable line of development of hydraulic machine tools offers an example. As long as the only means of providing hydraulic pressure was the accumulator, advance was not easy. But the improvement of the gear pump on the one hand, and the successful development of variable delivery pumps on the other, have opened an entirely new field for the designer, and have brought the extension of hydraulic operation, not only much nearer, but quite close. We cannot indeed yet foresee the day when hydraulic feed will be so accurate that screw cutting without dies may be done by it, but ordinary feeds in which absolute accuracy of movement is not essential are now attained in several machines of different types. The advantages are considerable. In the first position we may place cost. Machine tools are nowadays such expensive appliances and so many are required that anything that will reduce the expenditure upon them is of great moment. The hydraulic machine with its absence of trains of gear and shafting is obviously easier and cheaper to produce than the normal pattern and though, at first, cost may remain high we anticipate that, for the same service, it will in time fall below that of mechanically operated tools. Then, again, it is probable that the cost of upkeep will be lower, so that the user will gain in both directions. But the absence of mechanism has another notable advantage. The danger of accidental breakages is reduced. It is quite easy to arrange in a hydraulically operated machine that no more than a specified maximum pressure can be exerted; if it is passed, then a loaded valve may lift and relieve the pressure. The same characteristic is employed where work has to be carried up to a definite point—as, for example, a collar on a shaft. The mechanical knock-out motion, beautiful as it is, disappears. The operating plunger drives the slide up against a dead stop without any risk of injury. Again, the manipulation of the machine is reduced to the greatest simplicity. The operator has no more to do than handle a few little knobs, which control the valves, to get any variation of feed that he may desire, and the range of feeds has no steps; it may be taken from zero to the greatest by perfectly even gradations. Finally, hydraulic operation holds out the possibility of attaining the greatest feeds which the development of new steels may permit without the introduction of costly mechanism, and in all probability with the expenditure of less power. For these and other reasons we think it may be expected that when four more years have elapsed and the next Machine Tool Exhibition opens, we shall see hydraulic operation far more extensive than it now is.

In a letter published in *The Times* on Friday

last, September 14th, Sir Alfred Herbert alludes to the machine tool industry as a trade barometer. As it is moving in an upward direction, we may take it that the elongated depression is at last filling up. Machine tools cannot be purchased if there is neither money nor credit, and will not be purchased unless work for them is in hand or in view. It may be true that a great many of the machines at Olympia, possibly even the majority, have been designed for the motor car manufacturer, whose business has been flourishing for some time. But many excellent machines which appeal to the general engineer are to be seen, and we understand that good business is being done in them. The general engineer may not be a willing purchaser in these hard times, but experience is showing that under present conditions very expensive machines, machines costing fifteen hundred to two thousand pounds apiece, may pay for themselves in a reasonable time by the saving of labour, and the excellence of the product. It is because British machine tool makers are showing themselves full of progressive ideas and active in their business that their industry is advancing. In no branch of engineering has there been, within recent years, say, since the coming of high-speed steel which forced makers to revise their designs, more notable progress than in the design and construction of machine tools of all kinds.

### Tank Engines and the Track.

DURING the last year or so there have been six derailments of tank engines which, it is safe to say, would not have occurred had the permanent way been in better condition. The first of these was not inquired into by the Ministry of Transport, probably because the engine re-railed itself at a level crossing three-quarters of a mile from the point of the derailment. The facts became public property, however, when the same engine was concerned subsequently in a more serious mishap. The latter accident occurred on August 20th last year near Bearsted, Southern Railway; the former at Wrotham on March 31st. Lieut.-Colonel Mount, in dealing with the later case, had to cover the earlier as well. He reported that at Wrotham the road at the site of derailment was in a cutting which was difficult to drain, and in some places, therefore, very wet, and on the night of the accident it was, and had been, raining very heavily. There was no evidence of spreading or failures of fastenings. The track had been relaid in 1905 with 85½ lb. rails, 45ft. long. The bottom was sandy, the ballast being shingle and sand of a somewhat light character. With regard to the second derailment, Colonel Mount said that the track in the cutting in question lacked the essential attribute of "permanent" way, viz., stable and efficiently drained foundation. It could only, therefore, have been reasonably relied upon to support with safety light and slow-speed traffic during a continuous period of wet weather such as had been experienced. But perhaps the state of affairs at the time can best be judged from the statement of the divisional engineer that had he known of the prevailing conditions he would have imposed a speed limit of 15 miles per hour on all traffic. Four days later there occurred the serious fatal derailment at Sevenoaks, which, it will be remembered, brought into prominence the question of the use of tank engines. Colonel Sir John Pringle inquired into that accident, and, among his conclusions, observed that his examination of the track in the vicinity of the scene of the accident and the actual survey made of the gauge and level of the rails led him to the conclusion that there was an insufficiency of hard and clean ballast foundation, a lack of proper drainage, and irregularities in the level and gauge of the rails, sufficient to set up serious rolling and lateral motion on tank engines travelling at high speed. Sir John added that he could not help believing that the heavy rainfall in the morning of the day of the accident may have caused the track to go down rapidly under traffic and have occasioned some of the irregularities subsequently observed and measured. The fourth derailment happened on the Great Western, near Bridgnorth, on January 13th last. That case also was inquired into by Colonel Mount, whose conclusions, as regards the track, were that the condition of the sleepers themselves made it unlikely that the road could be relied upon to carry, with a reasonable margin of safety, even the lighter tender types of engine at the speed at which it had apparently been customary to operate. The latest derailment which may be ascribed mainly to the condition of the road was that which occurred at Swinderby, L.M. and S. Railway, on June 6th. The track there was comparatively new, as it was relaid in 1921–22, but the chairs were fastened to the sleepers by only two coach screws. The sleepers, moreover, rested on old Trent gravel ballast, with broken slag laid above the bed of the sleepers. Sir John Pringle in his report, which has just appeared, says:—"This derailment was due to the movement of a tank engine of the 0–6–4 type at a speed of not less than 60 miles per hour over a track which was not of a sufficiently high class to justify such a speed," and adds "The sleeper bed . . . did not afford the resistance required against slewing of the track and two coach screws proved an insufficient fastening of the chairs to the sleepers to prevent spreading of the gauge under the strain set up on a straight line by the side to side thrust of the engine."

We are led to return to these questions partly because of a remark made by Sir John Pringle in his report on the railway accidents of 1927, but mainly owing to Colonel Mount's report on one of the six derailments which we have in mind. Sir John, in dealing with some of the available methods for the prevention of railway accidents, mentioned the betterment of track maintenance and foundation to keep pace with the growing weight of locomotives, especially those of the tank type. Colonel Mount's report refers to the derailment at Chatburn, on February 27th, of a London, Midland and Scottish express, consisting of five bogie coaches and a horse-box, drawn by a radial tank engine of the 2–4–2 type. That this case is not on all fours with the other derailments we have mentioned may be judged from the last paragraph of that officer's conclusions:—"I therefore attribute this derailment, which might well have had serious consequences, primarily to the failure of this inherently weak spring, the failure being simply hastened by the shocks received whilst the engine traversed defective permanent way at a speed for which the track was not fitted." We would here remark that whilst the line at Chatburn might perhaps be described as defective, it was less so than in some of the other derailments now being noticed. The inspecting officer observed:—"Obviously, heavy repairs were needed, coupled with correction in cant, or, in the alternative, the imposition of a corresponding speed restriction"—35 to 40 miles per hour, instead of the 60 miles per hour at which the train was travelling. Moreover, the failure of a spring on the engine was the primary cause. That fact has led to the resuscitation of previous cases of derailment on the Lancashire and Yorkshire section, in which engine springs have been alleged to have failed. The first two instances mentioned by Colonel Mount were those at Waterloo, near Liverpool, in 1903, and Wyre Dock in 1911, where "there seems to have been little doubt that the cause in both instances was the loss of one of the coupled wheel springs when the engine—pre-converted type with elliptical springs—was traversing a curve." In case the details of those two derailments may be of interest, we may recall that the Waterloo accident occurred on July 15th, 1903, and that six passengers and the fireman were killed. The engine was a 2–4–2 tank with a radial axle at each end. The late Mr. Hoy, the then chief mechanical engineer, was of opinion that the derailment was caused by an obstruction, but Colonel Druitt put it down to the bridle of the spring of the right coupled wheel breaking and the spring subsequently falling off. At the time of derailment the train was on a curve to the right and yet went off the line to the right. It was travelling at a high rate of speed, as 17¼ miles had to be covered in 20 minutes, and one recommendation made was a speed limit of 35 miles per hour. The Wyre Dock derailment occurred on February 15th, 1911, and, again, a 2–4–2 tank with radial axles was involved. After the accident the spring of the right-hand driving wheel was missing. Colonel Mount then proceeds to allude to the derailment near Hebden Bridge. That is the historical case of Charlestown Curve on June 21st, 1912, when four passengers were killed. The engine was of the same type, but one converted to superheat. The present report says that Hebden Bridge "is significant in respect of the abuse which heavy and new track received, and Colonel Druitt commented on the great strain thrown upon permanent way when this engine was run at high speed, viz., 60 miles per hour, over a properly transitioned curve of 30 chains radius with super-elevation of 5in. The road was forced bodily out of alignment over a length of 175 yards in rear of the site of derailment, the displacement beginning near the commencement of the curve and recurring at four other points, varying from 3in. to 5½in. at intervals of from 30 to 40 yards. On that occasion no defect in the engine was reported as contributing to the results." In the Chatburn case it is shown that the right-hand trailing coupled spring—and, for that matter, possibly also the corresponding spring on the left-hand side—was in an advanced state of fatigue, the former being much the worse of the two. Of the fourteen plates in that spring fatigue cracks of varying size existed in seven, and, possibly, in one other, at or near the nibs and on the top or tension side, the top two and the bottom three plates being found to be broken after the accident, the tenth plate being apparently so brittle that it broke during transit of the loose pieces for examination. Of the fourteen plates in the spring of the left trailing coupled wheel nine were sound. It is remarkable that on May 21st—subsequently to the Chatburn derailment—the same train, drawn by an engine of similar type, suffered another spring failure, also near Chatburn, but fortunately in that case there was no derailment. The cause there was the shearing of the right driving leading spring bracket rivets. It is only fair, in summing up these cases of spring failure on the tank engines on the Lancashire and Yorkshire section, that it should be observed that the report records that there are 265 engines of this class of the saturated type and 64 of the superheated type. The former have worked 205·6 million miles and the latter 20 millions before conversion and 13 millions since. That gives a total of 239 million miles or an average of 726,444 per engine. The adequacy of the design and strength generally of the springs in question does not seem to be in any doubt. Colonel Mount hesitates, therefore, to make any suggestions, particularly in view of the general immunity from accident caused by spring failure. At the same time he thinks it not unlikely that improvement could be effected in shop practice in various directions and points out that the nib form of construction, particularly that in the centre of the plate within the buckle, was, when the eleventh plate was submitted to the National Physical Laboratory, criticised by that body.

It is of interest, therefore, and of no little comfort that, despite the allusion to previous failures of engine springs on this particular type of engine, Colonel Mount has only one recommendation to make. He says that the case has thrown doubt to some extent upon the thoroughness and efficacy of the examination of individual plates in respect of the detection of cracks. It would seem, too, that no records are kept at Horwich showing, for instance, who made each examination and repair, what plates were renewed, the material concerned, the test carried out, &c. He understands that consideration is being given to the practicability of introducing a serial number and card system covering some of this information. Nothing further is said about the track so we feel compelled to draw attention to a feature which accompanied four, if not five, of the derailments that are mentioned in our earlier remarks above. The characteristic in question is that the track was due for renewal. At Wrotham it had been down for twenty-two years and was relaid after the accident; among the evidence in the Bearsted case was the testimony of the divisional engineer that "There was no deferring of maintenance because this track was about to be renewed," whilst at Sevenoaks it was due to be renewed in the summer or autumn of this year. The length at Bridgnorth was not due for relaying this year, but the programme embraced a considerable mileage in different places on the line in question. At Chatburn the curve approaching and through the station had been relaid in 1919, but at the site of derailment it was twenty-four years old and Colonel Mount observed, that in view of their age and state of wear the road and connections there were practically at the end of their life and the company's officers decided to renew them at once instead of in the present summer as had been arranged. At Bearsted, Bridgnorth and Chatburn speed restrictions should have been imposed, and we would suggest that there should be greater co-operation in this respect between the running, engineering and operating departments so that the engineering department may ensure a speed more suitable to the road. Speed restrictions are objectionable to the operating people, as they cause train delays and, may be, the engineering department does not care to ask for them, as that may imply a doubt as to the safety of the track. On the other hand, here are six cases of derailment which may tend to discredit the use of tank engines, whereas no accident would probably have occurred had the speed been limited to suit the condition of the road.

# The Brand System of Burning Pulverised Coal.

IN the very short history of the use of pulverised fuel aboard ship and the testing of burners and plant connected therewith, few more informative papers have been given than that which was read by Engineer-Captain J. C. Brand, R.A.N., at the Summer Meeting of the Institution of Naval Architects on July 12th, 1927. The paper was reprinted in an abstract form in THE ENGINEER of July 15th, 1927. It deals very broadly with the subject and gives the results of tests made by the author on the Australian naval vessel "Sealark" in 1918, and later tests made with Clarke-Chapman plant.

In a little over a year events have moved very rapidly.

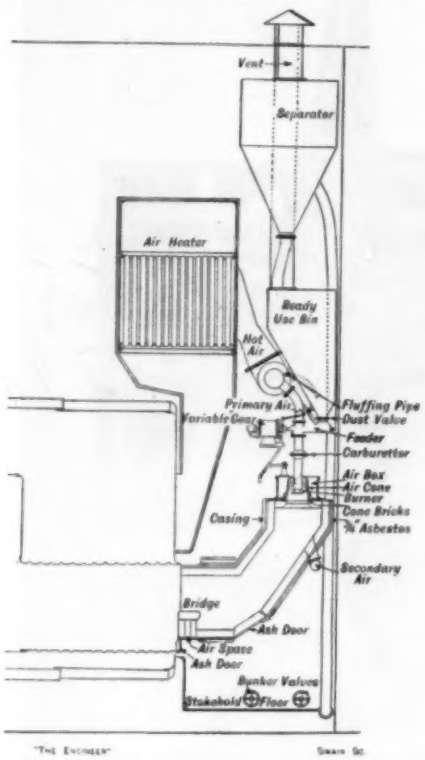



FIG. 1

Profiting by the investigations carried out by Messrs. Jefferson and Evans in America, the cargo ship "Mercer," burning powdered coal—see THE ENGINEER for December 16th, 1927—has made several successful Atlantic crossings. Clarke, Chapman and Co., Ltd., have also made considerable advances, and this week the Blue Star cargo steamer "Stuartstar," left the Tyne for South America with half her boilers equipped for the burning of powdered coal on the "Woodeson" system. Quite recently, new experiments have been carried out by Yarrow and Co., Ltd., at Glasgow, and by R. H. Green and Silley, Weir, Ltd., at Falmouth, while the Todd Shipbuilding Corporation in America has introduced a new type of unit pulveriser and burner. In his paper, Captain Brand discussed some of the relative advantages of the ready-use storage bin system which he proposes, compared with the direct-fired unit system to which class most of the plants above mentioned belong. In the bin system the pulverisers deliver their product by means of drying and carrying air into a cyclone separator, from which the dust is dropped by gravity into ready-use bins. It is carried from these bins to the burners by feeders, which definitely regulate the amount of fuel delivered. The carrying air is drained off from the top of the cyclone by the primary air fans, and is again introduced to the fuel at the feeders in the form of carrying air. At the Cambridge meeting Captain Brand demonstrated that when such bins are filled with inert gases no fire or explosion risk is present.

TABLE I.

| | |
|---|---|
| Date of test | May 23rd, 1928 |
| Duration | Seven hours |
| Steam pressure (average): | |
| (a) Gauge | 110 lb. per square inch |
| (b) Absolute | 125 lb. per square inch |
| Temperature of feed water | 43 deg. Fah. |
| Coal used on test | Darton Main slack |
| Calorific value (by bomb calorimeter) | 13,300 B.Th.U. per pound |
| Fusibility of ash | 1275–1285 deg. Cent. |

*Approximate Analysis of Coal.*

| | Raw coal. | Pulverised fuel. | Recovered after trial. | |
|---|---|---|---|---|
| | | | Ash from furnace. | Dust from tubes. |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Moisture | 1·0 | 0·4 | 0·3 | 0·6 |
| Volatile matter | 32·3 | 33·1 | 3·0 | 3·9 |
| Fixed carbon | 56·5 | 57·5 | 2·8 | 40·1 |
| Ash | 10·2 | 9·0 | 93·9 | 55·4 |

*Ultimate Analysis.*

| | Raw coal. | Pulverised fuel. | Recovered after trial. | |
|---|---|---|---|---|
| | | | Ash from furnace. | Dust from tubes. |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Moisture | 1·0 | 0·4 | 0·3 | 0·6 |
| Carbon | 74·4 | 76·8 | 5·8 | 39·1 |
| Hydrogen | 5·2 | 5·1 | — | 0·3 |
| Oxygen | 6·1 | 5·5 | — | 0·6 |
| Nitrogen | 1·3 | 1·3 | — | 0·6 |
| Sulphur | 1·8 | 1·9 | — | 0·7 |
| Ash | 10·2 | 9·0 | 93·9 | 58·1 |

Sieving test: 84·5 per cent. through 200 I.M.M. sieve; 90·2 per cent. through 150 I.M.M. sieve.

| | |
|---|---|
| Coal burned per hour | 348 lb. |
| Total coal burned on test | 2436 lb. |
| Total water evaporated | 22,330 lb. |
| Evaporation per square foot of heating surface per hour | 7·4 lb. |
| Evaporation per pound of coal (actual) | 9·17 lb. |
| Evaporation per pound of coal from and at 212 deg. Fah. | 11·2 lb. |
| Equivalent evaporation from and at 212 deg. Fah. per 1,000,000 B.Th.U. | 842·1 lb. |
| Gross Efficiency | 81·04 % |

*Summary of Heat Balance.*

| | |
|---|---|
| Steam (gross) | 81·04 |
| Flue gas | 16·2 |
| Ash | 0·3 |
| Radiation and unaccounted | 2·46 |
| | 100·00 |

*Flue Gas Analysis.*

| | |
|---|---|
| Percentage $CO_2$ (average) | 16·7 |
| Percentage oxygen | 0·9 |
| Percentage CO | 0·33 |
| Average temperature of flue gases: | |
| Before preheater | 380° C. |
| After preheater | 274° C. |

*Power Used for Auxiliaries.*

| | kW. |
|---|---|
| Primary and secondary air fans | 3·7 |
| Pulveriser | 2·64 |
| Pulveriser exhauster | 1·32 |
| P.I.V. gear | ·9 |
| Total | 8·56 |

It was thought desirable that some further full-scale and more extensive tests should be carried out on a Scotch boiler equipped with the "Brand" system, and tests of this kind were recently arranged by "B. & L." Powdered Fuel, Ltd., in conjunction with the Brand Powdered Fuel System, Ltd., and were carried out at the works of the first-named company at Barugh, near Barnsley, in Yorkshire. We were present during a part of these trials, and we are now able to give, by the courtesy of the company, the full figures for the No. 1 and No. 3 tests. Brief reference will also be made to No. 2 test, which was generally similar to No. 1, but was extended in that the ash and slag recovered from the furnace after the trial had been run were evaluated.

The Brand test plant is interesting in that it demonstrates what can be done in a 7ft. 6in. wide stokehold, with a single flue, 7ft. 7in. diameter by 7ft. 6in. long boiler, with a 430 sq. ft. heating surface and no superheater or economiser. The drawing reproduced in Fig. 1 shows the general layout of furnace employed. A P.I.V. variable speed gear enabled the amount of fuel delivered to the furnace to be varied between 100 lb. and 650 lb. of coal per hour. It will be seen that the pre-furnace is of the vertical type, which communicates with the boiler furnace proper, through an inclined shaft and a short horizontal connecting piece at the end of which a fire bridge is provided. It may be noted that the walls of the pre-furnace are asbestos lagged and the inner parts are lined with bricks of refractory material. The type of pre-furnace—shown in Fig. 1—was employed for tests Nos. 1 and 2.

The results of No. 1 test are summarised in Table I.

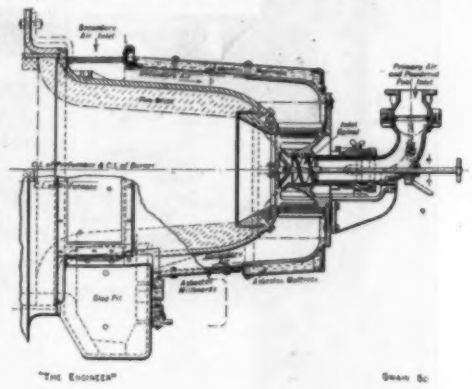
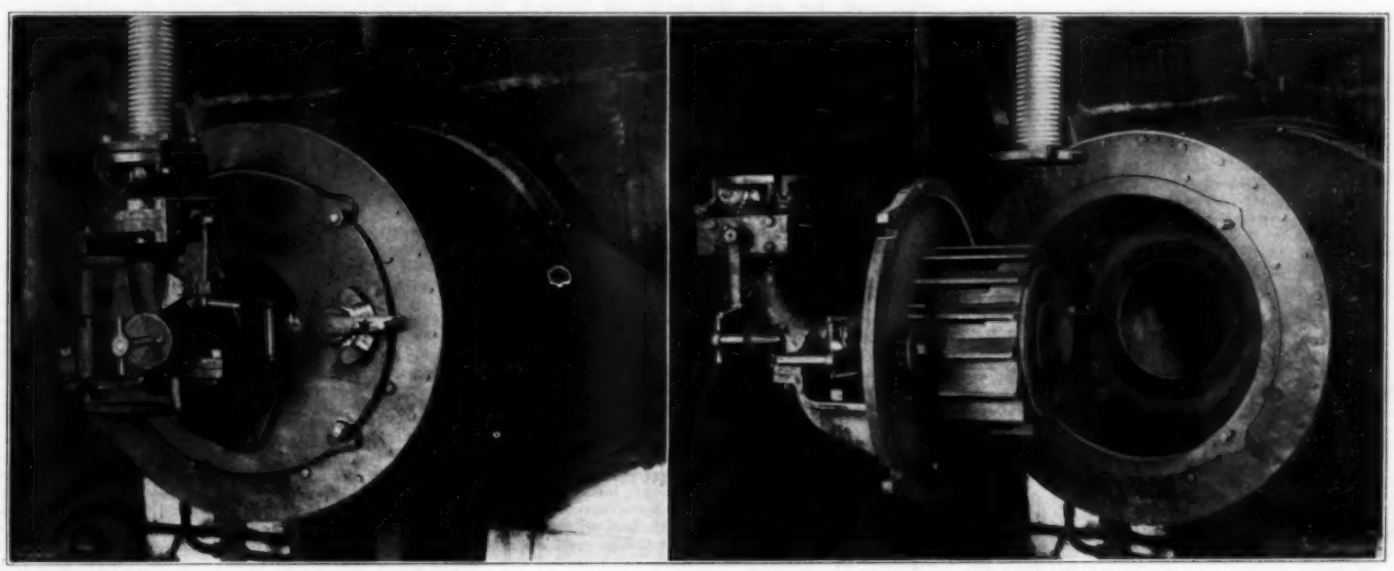



FIG. 4—BURNER WITH HORIZONTAL PRE-FURNACE

When the trial was completed, the refractory bricks were examined, and it was found that they had stood up satisfactorily to the high temperatures of the furnace and the slag. Flame temperatures ranging between 1500 deg. and 1600 deg. Cent. were recorded during this test. An analysis of the ash recovered showed that 79 per cent. was recovered from the furnace and smoke-box, and there was only 1·15 per cent. of carbon in the smoke-box residue.

No. 2 test was run on June 26th, 1928, and occupied 12 hours, part of which time we were present. The fuel was not ground quite so finely as that employed in No. 1 test; the sieving test showed that 1 per cent. passed through the 90 mesh, 23 per cent. through the 90 on to the 150-mesh, and 76 per cent. through the 150-mesh sieve. For this reason the results were not so satisfactory as those of the first test, but in general, however, they were comparable. In No. 2 test the total ash in the coal burned was 351·7 lb., of which total 262 lb. were recovered from the furnace and the back end of the boiler. In addition to this, 70 lb. of ash were taken from the tubes and smoke-box. The total recovered was therefore 332 lb. or 94 per cent. of that in the coal.

For No. 3 test a horizontal type of pre-furnace was employed, a section through which is given in Fig. 4. A cast iron body lined with fire brick is employed, and, as shown in Fig. 3, the whole furnace can be swung back, giving access to the main furnace. Figs. 3 and 4 show the



FIGS. 2 & 3—BRAND BURNER WITH HORIZONTAL PRE-FURNACE

arrangements for heating the secondary air and delivering it to the centre of the burner through louvres, which can be operated by the pinion gear shown clearly in Fig. 3. The powdered coal and primary air pass down from the supply bin through a flexible "Tubo-Flex" hose made

by the Power Flex Tube Company, of London. There is a loose coupling which can be undone when it is required to swing back the burner. The primary and secondary air and the fuel, all meet at the centre of the burner and are given a whirling motion by means of the spiral at the mouth of the burner. The spreader cone at the end of the burner regulates the size of the burner aperture, and consequently the character of the flame. This cone may be adjusted from outside the burner by the extended handle shown. There are mica-covered inspection windows and a torch door, and a slag pit is also provided, so that ashes and slag can be conveniently removed.

TABLE II.

| | |
|---|---|
| Date of test | August 10–11th, 1928 |
| Duration | 24 hours |
| Steam pressure (average): | |
| (*a*) Gauge | 115 lb. per square inch |
| (*b*) Absolute | 129·7 lb. per square inch |
| Temperature of feed water | 58 deg. Fah. |
| Coal used on test | Darton Main slack |
| Calorific value (by bomb calorimeter) | 13,300 B.Th.U. |
| Fusibility of ash | 1275–1285 deg. Cent. |

*Approximate Analysis of Coal.*

| | Raw coal. | Pulverised fuel. | Recovered after test. | |
|---|---|---|---|---|
| | | | Ash from furnace. | Dust from tubes and smoke-box. |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Moisture | 0·4 | 0·3 | 0·1 | 0·3 |
| Volatile matter | 34·6 | 33·5 | — | — |
| Fixed carbon | 57·9 | 58·0 | 1·8 | 27·1 |
| Ash | 7·1 | 8·2 | 98·1 | 72·6 |

| | |
|---|---|
| Sieving test: 81·5 per cent. through 200 I.M.M. mesh screen. | |
| Coal burned per hour | 292 lb. |
| Total coal burned on test | 7010 lb. |
| Total water evaporated | 61,990 lb. |
| Evaporation per square foot of heating surface per hour | 6·0 lb. |
| Evaporation per pound of coal (actual) | 8·84 lb. |
| Evaporation per pound of coal from and at 212 deg. Fah. | 10·78 lb. |
| Equivalent evaporation from and at 212 deg. Fah. per 1,000,000 B.Th.U. | 804·4 lb. |
| Gross efficiency | 77·2% |

*Heat Balance.*

| | Per cent. |
|---|---|
| Steam (gross) | 77·2 |
| Flue gas | 16·1 |
| Ash | 0·2 |
| Radiation and unaccounted | 6·5 |
| | 100·0 |

*Flue Gas Analysis.*

| | |
|---|---|
| Percentage $CO_2$ (average) | 14·7 per cent. |
| Percentage O | 2·1 per cent. |
| Percentage CO | 0·2 per cent. |
| Average temperature of flue gases: | |
| Before preheater | 421 deg. Cent. |
| After preheater | 250 deg. Cent. |

*Power Used for Auxiliaries.*

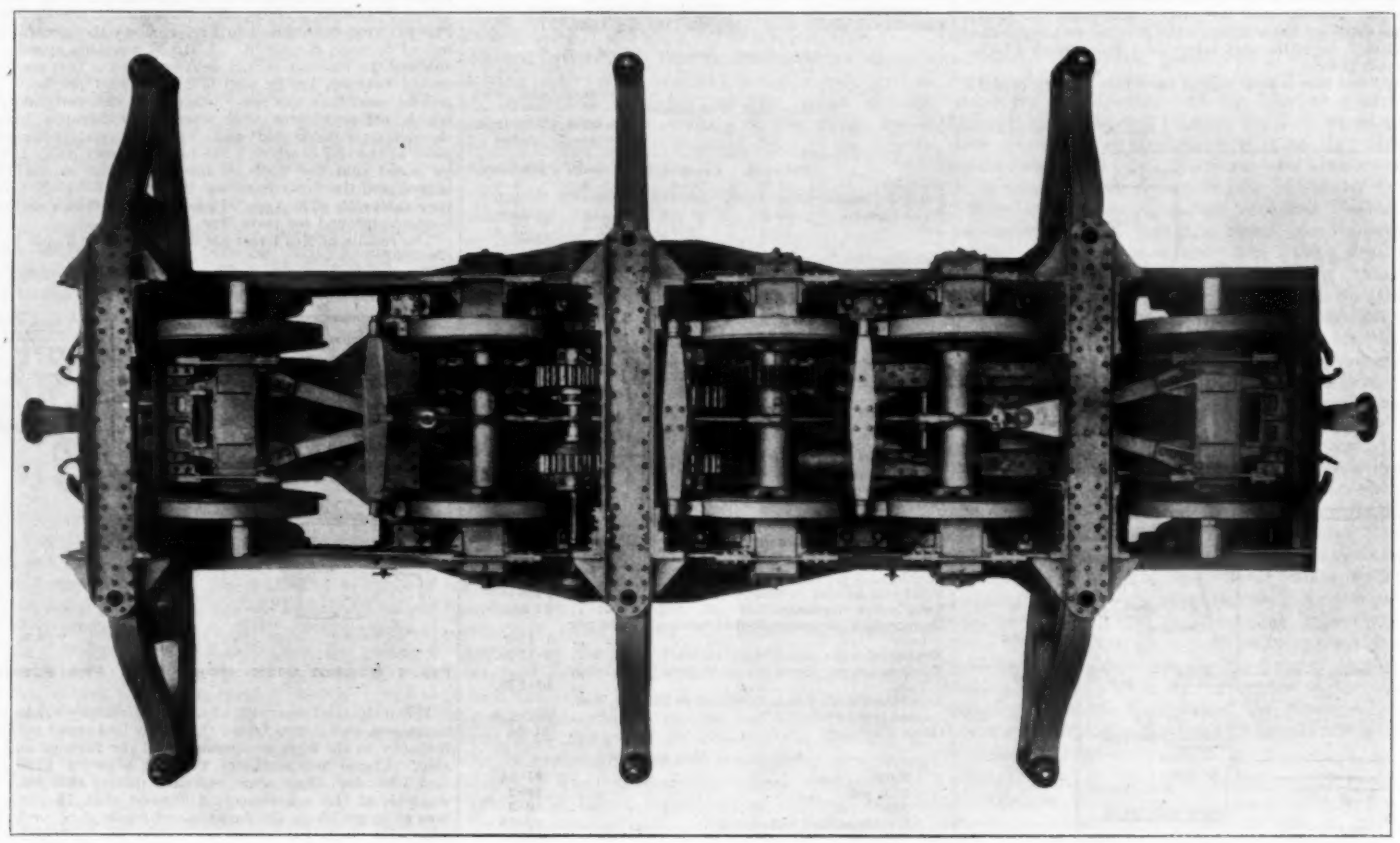
| | kW. |
|---|---|
| Primary and secondary air fan | 2·64 |
| Pulveriser | 3·4 |
| Pulveriser exhauster | |
| P.I.V. gear | 1·05 |
| Total | 7·09 |

The results of No. 3 test are given in the accompanying Table II., and are quite as good as the No. 1 test results. Furnace temperatures of from 1400 deg. to 1500 deg. Cent. were recorded, and an analysis of the smoke-box residue showed that it contained a 1·25 per cent. carbon content.

Arising out of the tests the following facts presented themselves. The pre-furnace seems to serve a useful purpose in maintaining the temperature of the furnace at any desired point, either fusing the ash into a slag or not fusing. The fused slag can be run off or raked out, and the amount of carbon content carried over to the smoke-box is, as the tests show, very small. The pre-furnace also helps to keep down dust in a way that is not possible with direct firing. The cooling of the refractory material used to line the pre-furnace presents a problem. Experience showed that with the air-cooled walls slag containing a high percentage of iron oxide readily combines with the silica and alumina contents of the fire bricks, and rapidly washes them away. Extremely high temperatures are experienced and air cooling only becomes effective when the bricks have washed down to a thickness of something less than 2in. It would appear that with air-cooled walls only bricks with a high silica-alumina content may be employed when a high fusion point ash is present. The other alternative is to use water-cooled walls, and we have inspected a design of a pre-furnace of the type shown in Figs. 2 and 3, which is now being built, on which water-cooled walls are used, the circulating passages being employed as feed-water heaters.

During the trials we have referred to, the coal was pulverised by a "Rema" pulveriser, supplied by the British Rema Manufacturing Company, Ltd., of Halifax.

The bin system was shown to be extremely flexible in that the pulveriser could be stopped and the burner run from the bin, and the correct amount of air be used for such low feed rates as 100 lb. of coal per hour when starting up the boiler. This would seem to be an advantage in an actual installation, as when entering harbour or manœuvring in narrow waterways the pulveriser could be stopped and the *personnel* set free for other duties. From the experiments made and the cost of the plant, it is anticipated that the price of a bin storage installation will not exceed that of a direct-feed installation, especially as the prices of pulverisers do not increase in proportion to their output. This being so, the cost of two larger pulverisers such as are used with the bin system will probably be little more than that of the four or more required for direct firing. The tests were of considerable interest and we look forward to the early application of the Brand bin system of pulverised fuel burning to an actual marine installation.



UNDER-VIEW OF CRAVEN'S BREAKDOWN CRANE WITH OUT-RIGGERS EXTENDED

## Railway Breakdown Cranes.

IN THE ENGINEER of July 27th last we published an article contributed by "An Assistant Locomotive Superintendent" on "Railway Breakdown Equipment," in which the author called attention to the difficulties incidental to the construction and operation of breakdown cranes. He mentioned several defects in cranes which had come within his personal experience. One of these was the liability to derailment on curves owing to the rigid arrangement of the axles when the crane was self-propelled. Another defect to which the author alluded was the arrangement of the transverse girders which are used for shoring up the crane when heavy lifts have to be taken, and there were several other defective features which the author said required to be improved.

It is gratifying to learn that these defects no longer exist on some English cranes. Craven Brothers (Manchester), Ltd., have for many years given the design of high capacity breakdown cranes very careful attention, and claim to have evolved machines which are capable of meeting all the requirements likely to occur in use and wherein the defects mentioned by the author of the article referred to have been remedied. Illustrations on this and the opposite page show Craven Brothers' latest construction. In these cranes reliability has been made a first consideration. A high margin of stability, ample bearing surfaces for all running parts, and first-class materials and workmanship have been provided The makers' aim has been to build these cranes according to the best locomotive practice, especially as far as the under-carriage is concerned. Further, except for such parts as the engine cylinders, hoisting and derricking barrels, boiler baseplate and counterweight, brake shoes, &c., cast iron has been eliminated, the whole of the gearing, bearings, brackets and wheels being of steel.

To give smooth running and freedom from derailment on sharp curves, these cranes are given an effective distribution of wheels and axles, with three axles on a short rigid wheel base, and the leading and trailing axles are carried in radial pony trucks with centralising springs. This arrangement gives sufficient flexibility to enable the crane to take small curves smoothly and without grinding, the total weight of the crane being distributed, as far as possible, equally over all axles. Setting down or levelling screws and pads are provided over all springs to prevent them being over-stressed when the crane is handling loads, and also to level up the under-carriage on inclines or to correct the super-elevation when working on curves, thus making the crane stable and giving steady and controlled movement of slewing operations. Each corner of the under-carriage is provided with screw clips for both of the rails.

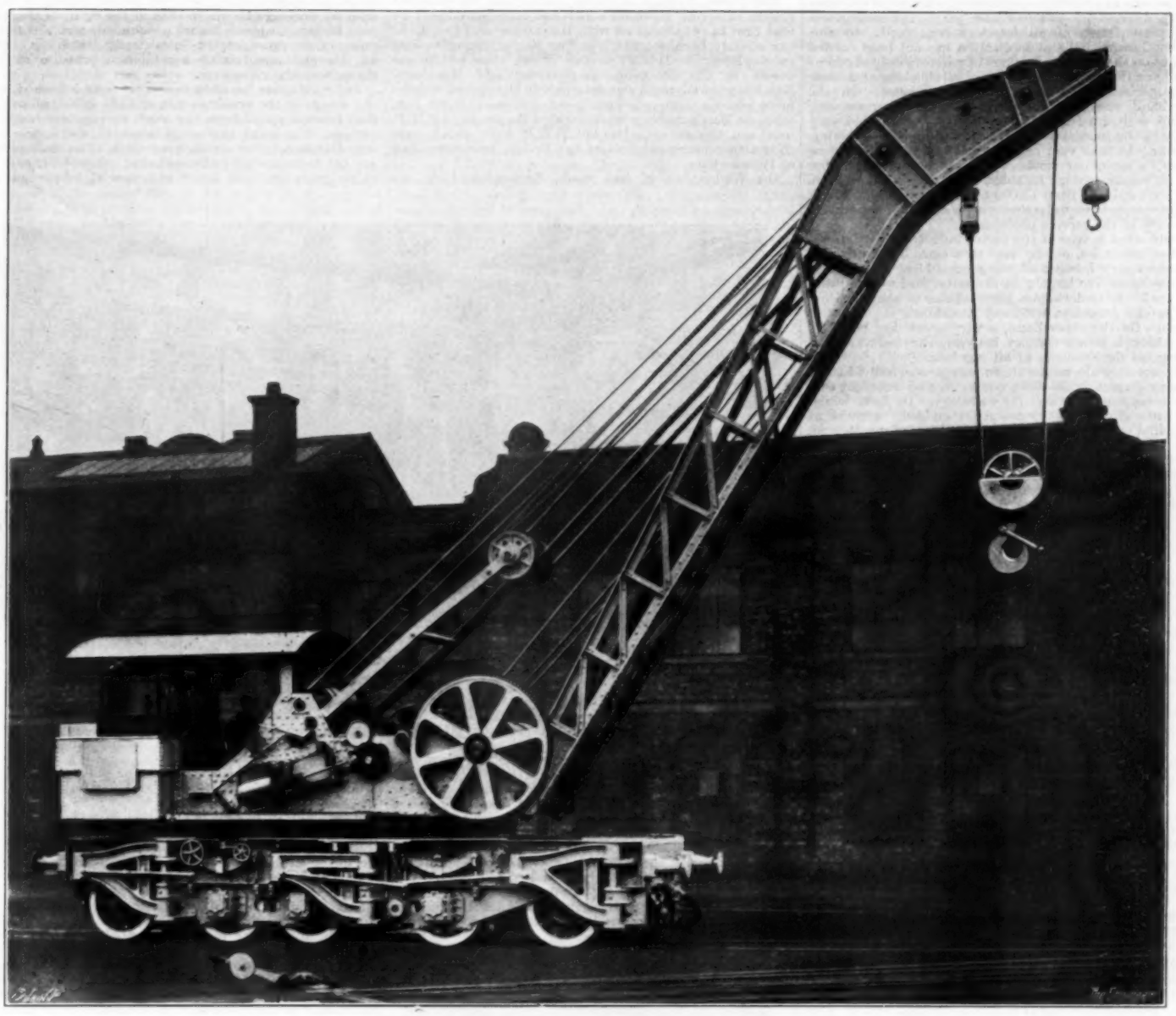
The under-carriage, it will be noted, is built with hinged steel out-rigger brackets with jack screws and blocks for propping up the crane when handling heavy loads. This arrangement is an improvement upon the telescopic draw-out beams, as the hinged brackets can be readily manipulated by one man, and are much quicker to operate. Further, they permit a stiffer type of carriage structure to be incorporated, the effective depth of the side plates being practically doubled, and the two sides of the under-carriage structure are tied together by transverse bracing ties. This can be readily seen from the illustration above, which shows the underside of a breakdown crane under-carriage for a 3ft. 6in. gauge track.

Two axles on the rigid wheel base are arranged to be driven for travelling the crane by its own power; these axles are fitted with spur wheels driven by pinions mounted on sliding sleeves, so that by means of hand wheels and screw gear they can be slid out of mesh when the crane is required to travel in train order. Instruction plates are fitted in proximity to each hand wheel. An adjustable Weston disc slipping clutch is provided in the gear train of one of the pinions to prevent gears becoming locked owing to relative creep between two axles, and also to assist in the engagement of the pinions.

The crane is fitted with vacuum brake, train pipe and fittings, the three pairs of wheels on the rigid wheel base being provided with compensated brake shoes. Provision is also made to operate these shoes by hand, through hand wheels on either side of the under-carriage. The hand gear is self-locking, but is provided with a clutch so that by pulling or pushing at the hand wheels the brake can be immediately released. A steam brake cylinder operated

## RAILWAY BREAKDOWN CRANE

CRAVEN BROTHERS (MANCHESTER), LTD., MANCHESTER, ENGINEERS



from the working platform on the super-structure is also incorporated, so that the crane operator has full control of the travelling movement of the crane from his working position.

The main roller path is the maximum diameter which the running gauge permits, and the slewing rack has teeth machine cut from the solid. The slewing rollers are of cast steel and of large diameter, carried on a centre spider, and are arranged so that any roller can be readily removed from its place without having to disturb the super-structure. The crane jib has a deep swan neck, giving the maximum clearance under the jib structure when handling wagons, &c.

The rope reeving is such as to afford great facility for handling loads of all tonnages up to the maximum, the speeds and range of lift being greatly increased when dealing with lighter loads. The arrangement is designed so that the change over to either of the various systems can be effected in a minimum of time.

Shafts revolve in gun-metal adjustable steps with removable caps, the hoisting barrel, motion, engine and way shafts being arranged so that they can be removed without disturbing the adjacent gears. The way shaft has reversing mitres and clutches for travelling, derricking and slewing motions, the latter having friction cones with self-adjusting gun-metal friction pads. All motions are provided with ample brakes, the hoisting hand brake being of large diameter with lock-on foot lever. The slewing and derricking brakes are of the screw-down type.

The boiler is of the Hopwood type, and the engines are substantially built, and have Walschaerts valve motion. All the motion work is on the outside of the super-structure frames and perfectly accessible. Further, the superstructure frames are not weakened by being cut away to clear the steam chest. The operator's shelter is arranged so that a clear view of the load when lifted can be obtained. An automatic indicator mounted near the operator's working platform gives the maximum loads and working radii, and is so arranged that it can be simultaneously read by the operator and from the track level.

---

IT is claimed that the "Virginia," which has just been launched at Newport News, is the largest passenger vessel ever built in the United States. She is 613ft. long, 80ft. beam, and of 34,000 tons. She will be electrically driven, and is expected to have a speed of 21¾ miles per hour.

## Standardisation—Its Economic Basis.*

By C. LE MAISTRE, C.B.E.

IT has been my privilege on more than one occasion to read a paper on "Standardisation and the Work of the B.E.S.A." before the Engineering Section of the British Association. There is no doubt the engineers of the country and quite a number of progressive business men are, generally speaking, converted to the benefits of standardisation carried out nationally with the strictest precautions to prevent interference with invention and design and with proper arrangements for review and revision when practical experience and progress dictate. It is, however, a question as to the extent to which the economic value of standardisation is realised by the management and the directors of the various firms.

In the short space allotted to me it is neither possible nor is it necessary to do more than provoke a discussion. Therefore I will only touch very briefly upon a few of the more important underlying principles, leaving on one side many interesting aspects into which it would take too long to enter.

Since the war the producing countries have all, to a greater or less degree, been forced, by economic pressure and the hope of increasing their export trade, to give far greater attention to this subject than hitherto, and no country has given it greater attention or more publicity than the United States of America. This will be appreciated when it is stated that in 1926 it is estimated that over one and a-half million pounds was expended in that country on standardisation. It was stated then that there were five national standardising bodies, over 100 trade organisations, and over fifty Government Bureaux doing standardisation work of one sort or another. Whilst this must have meant considerable overlapping of effort, on the other hand, very large economies must have resulted or the work would not have been undertaken.

In Europe, whilst we in this country have the oldest national organisation, Germany has probably the largest scheme of standardisation, and is influencing the whole of the Continent in that direction. It has often been stated that the Germans thereby hope to capture the export trade, especially of the engineering and allied industries.

* British Association. Section F. Economics.

Czechoslovakia—one of the youngest republics—has, for its size, probably as active a standards organisation as any country; the manufacturers financially supporting it to a far greater degree than in most other countries.

Russia also has recognised the economic value of standardisation, particularly in connection with exportable raw materials where proper grading is necessary for profitable marketing, which can only be reached through standardisation.

In any general discussion on such a subject as this it is of the utmost importance that the terms used by the various speakers should, if possible, be identical, or at any rate approximate to such a degree as to avoid misunderstanding. Most people will agree that no movement has ever been so hampered by its title as standardisation, for the term lends itself to so many interpretations.

It is often thought to imply crystallisation, whereas the movement, at any rate in this country, stands for an entirely progressive and co-operative effort. It will perhaps be well if I make distinction between dimensional standards and those of quality, rating, performance and tests, the latter of which enable comparisons of tenders to be made. A further division—a somewhat arbitrary one—of simplification has also to be considered.

The American Government, up to the present, appears to have regarded simplification as the more commercial part of the process dealing solely with the reduction of the variety of types to the least possible number. Industrial standardisation, according to the experience of the B.E.S.A., provides an equitable basis for the comparison of tenders by simplifying and standardising both on the production side as well as on the commercial side, thus benefiting both the producer and the consumer. The very first piece of work of the B.E.S.A. over a quarter of a century ago was that of simplifying the large variety of steel sections then being made. These were finally reduced to 113, thereby saving, at that time, 5s. per ton, or a million a year.

It is quite probable that in America it may be found expedient to make less and less distinction between the two processes. In this country our experience has repeatedly shown that with the community of interest of purchaser and producer recognised in the work, simplifying practically always leads to agreement on industrial standards. I am convinced, from experience, that to reach the most economic results the work must be carried out nationally. It would also seem that the greatest benefits are likely to accrue in those industries which are well

organised and therefore able to arrive at a consensus of opinion of their industry on the various problems involved. The success of the B.E.S.A., which, as you probably know, is not a profit-making concern but exists solely to benefit industry and to be of service to the community, is in large measure due to its recognition from the outset of the community interest of producer and user. Its committees are representative of all interests concerned. In this country dimensional standardisation has not been carried so far as on the Continent, where apparently only of recent years have the economic benefits of establishing standards of comparison for tenders been appreciated. On the other hand, one must not forget that interchangeability coupled with drastic simplification has contributed very largely to the success of the American motor car industry. According to that vast organisation known as "General Motors," a motor car consists to the extent of nearly 70 per cent. of minor parts. In their works these minor parts have been reduced from 13,000 to just over 2000. Think of the decrease in manufacturing costs and the comparative simplicity of the service problem.

Surely what is true of the motor industry must be true of other industries, at any rate to a considerable extent. In this country because of our geographical position our manufacturers live largely on diversity, and we are probably unable to undertake a huge scheme of simplification such as the American with any possibility of economic success. On the other hand, a very great deal could be done through closer contact between the technical and commercial departments of all our firms.

We certainly do not wish to merge our individuality in too much standardisation, nor to give up our right to a certain amount of scope for selection. In fact, whilst experience shows that industrial standards, arrived at nationally, which provide an equitable basis of comparison, be it for quality, performance, or tests, are invaluable aids to economic production and tend to simplify commercial transactions, there is no doubt that too much simplification and standardisation of particular articles has the danger of leading to sterilisation.

## BOOKS RECEIVED.

*City of Salford, Electrical Engineer's Annual Report and Statement of Accounts for the Year ended March 31st*, 1928.

*The Bristol Fighter, Mark IV.* London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. net.

*Underground Practice in Mining.* By Bernard Beringer. London: Mining Publications, Ltd., 724, Salisbury House, E.C. 2. Price £1 net.

*Exhaust Steam Engineering.* By Charles R. Darling. London: Chapman and Hall, Ltd., 11, Henrietta-street, S.W. 1. Price 30s. net.

*The Siskin IIIA Aeroplane Jaguar Engine.* London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C 2. Price 1s. net.

*The R.I.B.A. Calendar*, 1927–1928. London: The Royal Institute of British Architects, 9, Conduit-street, Hanover-square, W. Price 3s. 9d. net.

*Parallel Tables of Slopes and Rises.* By C. K. Smoley. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. 4. Price 24s. net.

*Engineering Workshop Manual.* By Ernest Pull. Sixth edition. London: Crosby Lockwood and Son, Stationers' Hall-court, E.C. 4. Price 2s. 6d. net.

*Tolley's Income Tax Chart Manual.* Thirteenth edition. 1928–29. London: C. H. Tolley, 4, Great Winchester-street, E.C. 2. Price 3s. 6d. post free.

*The Recovery and Use of Industrial Wastes.* By J. B. C. Kershaw. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price 25s. net.

*Théorie calcul et Construction des Cheminées D'Usine.* By E. Lafon. Paris: Librairie Polytechnique Ch. Béranger, 15, rue des Saints-Pères. Price 50f. net.

*The Installation of Electric Lighting and Heating.* By F. H. Taylor. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 7s. 6d. net.

*The Journal of the Iron and Steel Institute, Vol. CXVII., No. 1.* Edited by G. C. Lloyd. London: The Iron and Steel Institute, 28, Victoria-street, S.W. 1.

*The Problem of Motor Transport: An Economic Analysis.* By C. T. Brunner. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price 12s. 6d. net.

*The Hyderabad Aircraft (Two Lion Engines), being Air Publication 1318 of the Air Ministry.* First edition. 1928. London: H.M. Stationery Office. Price 2s. net.

*The Journal of the Institute of Metals, Vol. XXXIX., No. 1.* Edited by G. Shaw Scott. London: The Institute of Metals, 36, Victoria-street, S.W. 1. Price 31s. 6d. net.

*Port Studies: With Special Reference to the Western Ports of the North Atlantic.* By Brysson Cunningham. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 25s. net.

*Smoley's Parallel Tables of Logarithms and Squares.* Ninth edition. By C. K. Smoley. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. 4. Price 27s. net.

*Cements, Limes and Plasters: Their Materials, Manufacture and Properties.* Third edition. By Edwin C. Eckel. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 35s. net.

*Dielectric Phenomena. II., Electrical Discharges in Liquids.* By S. Whitehead, edited by E. B. Wedmore. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price 12s. 6d. net.

*Illustrated Technical Dictionaries. Volume II., Electrical Engineering and Electrochemistry.* Edited by Alfred Schlomann. London: Lowenz and Wilkinson, Ltd., 25, Victoria-street, S.W. 1. Price £4 net.

*The Structure of Vortex Sheets, being Reports and Memoranda No. 1143 (Ae. 311) of the Aeronautical Research Committee of the Air Ministry.* By A. Fage, A.R.C.Sc., and F. C. Johansen, B.Sc. H.M. Stationery Office. Price 1s. net.

# A 935 B.H.P. Airless-Injection Oil Engine.

THE Davey-Paxman oil engine, embodying the patented system of spring injection which has been introduced by that firm in collaboration with Blackstone and Co., Ltd., has already been described in THE ENGINEER. The first twin-cylinder 80 B.H.P. engine of this type which was shown at the Shipping, Engineering and Machinery Exhibition at Olympia was described in the special Supplement which accompanied our issue of September 9th last, while on March 2nd last we illustrated the single 25 B.H.P. unit and the six-cylinder 420 B.H.P. unit which were shown as running exhibits at the British Industries Fair at Birmingham.

On Wednesday of last week, September 12th, we attended the acceptance trials of a new eight-cylinder engine of this type, which is shown in Fig. 1. It has a designed output of 935 B.H.P., when running at 300 r.p.m., and it is to be coupled to a 600-kW, 6600-volt, three-phase alternator, supplied by the English Electric Company, Ltd., which is shortly to be installed at the electricity works of the Ashford Urban District Council in Kent. The station is one of the most recent electricity undertakings in which oil engines are exclusively used for generating the current, and the present plant includes three 600 B.H.P., 400-kW Ruston Hornsby-English Electric generator sets. The demand for light and power has increased so rapidly that the new set will be required early in October. We are informed by the Council's electrical engineer, Mr. H. Wilson, A.M.I.E.E., that the fuel costs at this station do not exceed 0·25d. per unit generated, and are often lower.

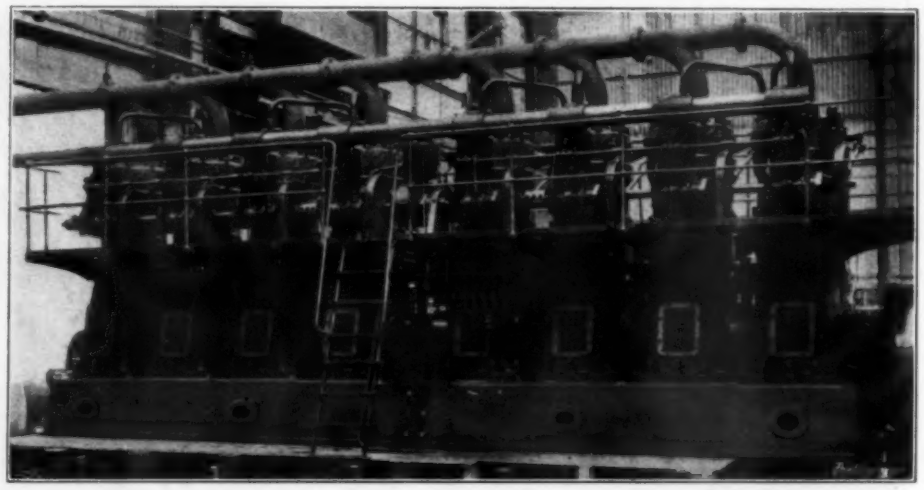


FIG. 1—935 B.H.P. EIGHT-CYLINDER AIRLESS-INJECTION OIL ENGINE

The engine we are describing has 15¼in. diameter cylinders and a stroke of 20in., and it is to be capable of sustaining a maximum load of 1070 B.H.P. At the time of our visit the unit was running very quietly on about 600 B.H.P., being coupled to two Prony brakes. Lack of cooling water prevented the makers from putting on the full load. The fuel which was employed for the trial run was a British Petroleum B grade Diesel oil, of about 0·92 specific gravity, and a heating value of approximately 18,000 B.Th.U. per pound. The exhaust was quite clear when seen against the sky, a very faint bluish haze only being shown when it was seen against a black background. The guaranteed fuel consumption figures were 0·40 lb. per B.H.P. hour at both full and three-quarter load and 0·44 lb. at half load. On the 600 B.H.P. trial a figure of 0·39 lb. was obtained from which the makers anticipate that the full load and three-quarter load performances will be in the neighbourhood of 0·38 lb. per B.H.P. hour.

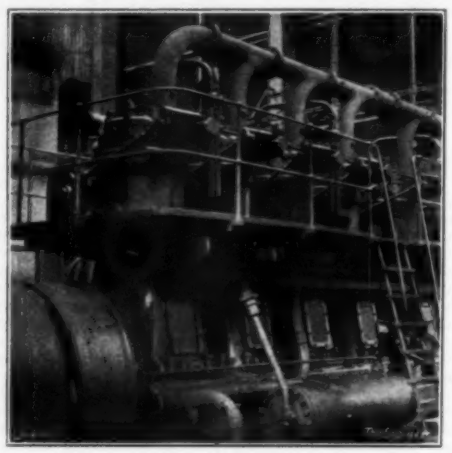


FIG. 2—BACK VIEW SHOWING EXHAUST VALVE GEAR

The outstanding feature of the new design is that the engine is fully enclosed and that it works on a forced lubrication system, operating at a normal pressure of 10 lb. per square inch. The lubricating oil pump, which is of the Stothert and Pitt "Feuerheerd" type, is placed at the back of the engine, and it works in conjunction with a large oil cooler. The pump draws from the oil from the suction tank through the cooler, and delivers it to the mains through a pressure-adjusting chamber, with a hand control wheel, enabling the pressure to be regulated between 5 lb. and 35 lb. per square inch. The oil pressure gauge is fitted with an electrical alarm, so that in the event of the pressure failing, an alarm signal is sounded, and a stand-by pump of the same pattern—electrically driven—is started up, thereby maintaining a minimum pressure of 5 lb. throughout the oil system.

Particular care has been taken, we were informed, with the design of the crank guards and the splash guards, so that lubricating oil from the crank case cannot reach the pistons. The crank case space is vented, and connections may be taken to the air inlet manifold. The main pistons are fed from mechanically operated lubricators, and the valve gears are also fitted with special lubrication and oil baths, giving continuous lubrication of the working parts. The main crank shaft is of the solid forged type made in two pieces, which are joined at one of the webs. A new type of indicator gear has been fitted, which is always ready for operation.

Fig. 2 shows the back of the engine at the fly-wheel end. The horizontal air inlet valve and vertical fuel valve—see Fig. 1—are worked by cam levers from the lay shaft, while the exhaust valve mechanism is of the firm's Lentz pattern and is arranged at the back of the engine—see Fig. 2. The gear ran very quietly. The fuel oil is delivered to the steel blocks on the cylinder heads at a pressure of 25 lb. by the measuring pumps, which are governor controlled through a simple wedge mechanism. A fuel filter of the self-draining and self-venting type is fitted to each fuel pipe. The pressure of 25 lb. is raised to 1050 lb. to 1100 lb. in a spring plunger, operated by the valve lever which is arranged in the spray valve head. There are four very fine holes in the nozzle, and when the pressure of the spray valve closing spring is relieved by the lever tappet, the full pressure of the oil charge in the spring-controlled plunger chamber is available to atomise the fuel oil and introduce it into the working cylinder. On a demonstration valve we were shown that the system is one which can give fine and complete atomisation, no matter the amount of oil it is desired to inject into the cylinder. Owing to this fact, it is claimed that the engine will fire regularly and develop its full torque at speeds below 100 r.p.m., although it is designed to run at 300 r.p.m. normally.

Some special provisions are made for speed control. The governor, which is of Davey-Paxman's standard type, is mounted at the centre of the engine with a tachometer on the top. It acts directly on to the fuel measuring pumps, and it is fitted with hand-speed control, which can be operated either from the top platform or below at the engine control station. An emergency governor with an oil-servo relay is also fitted, which, in the event of the speed rising 10 per cent. in excess of the normal, shuts down the engine. Provision is made for the electrical operation of the main governor from the switchboard, should this prove desirable at a later date.

The engine is started on compressed air, which is supplied to four cylinders at 300 lb. pressure. Satisfactory starting trials were demonstrated. We were informed that the engine was started up on Thursday night, September 6th, and had been running practically since that time. An engine of similar design working on the spring-injection system has, we understand, been run for 9040 hours over a period of fourteen months without requiring any attention to be given to the fuel injection valves.

The engine we have described marks the further development for larger powers of an engine of British design, and we were pleased to see at the time of our visit a large number of units going through the shops.

WHEN the Genoa and Turin wireless stations are completed towards the end of this year, Italy will possess six broadcast transmitters. The newest installation was completed in thirty-two days, the Ente Italiano per le Audizioni Radiofoniche having decided upon its erection only a month prior to its inauguration on July 12th last. Situated between Merano and Bolzano in Italy's Alpine provinces—formerly Austrian—the station's aerial power is 200 watts and its wave length 400 m. (750 kc.); the two-wire L-type antenna is suspended between two lattice steel masts 131ft. high and 262ft. apart. The copper wire earth network is 2ft. below the surface.

## The Control of the Guadalquivir.

ONE of the most interesting of the many schemes now under consideration for the development of the resources of Spain is that relating to the Guadalquivir—Wadi-l-Kebir, or "the Great River"—a brief outline of which is given in the *Revista de Obras Publicas*. The works proposed for hydro-electric power, for irrigation, and for making the river navigable far upstream from Seville are to a large extent interdependent. Considering the project as a whole, the creation of large additional water storage, on which all the works would depend in greater or less degree, will obviously be less costly in proportion to results if works of all three classes be carried out in due proportion. Further, the canalisation of the river, involving the building of weirs the drops of which will aggregate 90 m., or, if the second part of the project be also carried out, 240 m., will provide opportunities for making use of water power. On the other hand, the creation of numerous reservoirs for the production of power on a larger scale and for irrigation will assure sufficiency of water for navigation at all seasons of the year.

*Navigation.*—The river is at present navigable only up to Seville, some 63 kiloms. It is proposed to build weirs and locks upstream to Cordoba, about 170 kiloms. The difference of river levels is about 90 m. and eleven locks are proposed. Should this scheme be successful the river would be similarly canalised, with nineteen weirs, up to Baeza, a like distance further upstream, the difference in levels being 150 m., making a total of 240 m. with thirty weirs and locks. These were the proposals in 1919 of D. Carlos Mendoza.

*Reservoirs.*—The combined capacity of reservoirs already made and under construction will amount to 498 million cubic metres. Others, already projected but requiring further study, may store a further 500 millions, but in the comprehensive scheme now proposed it is intended to bring the total storage up to 3000 million cubic metres. All the reservoirs would be on right bank tributaries or on head waters of the Guadalquivir. It is estimated that the mean flow of the regulated river will be 59 mecusecs, or 2083 cusecs.

*Irrigation.*—There are now under irrigation about 133,000 hectares—329,000 acres—which will be increased by 33,500 hectares—82,800 acres—when works now in hand are completed and, if all the works in the scheme be carried out, to 435,000 hectares—1,075,000 acres. The principal irrigated and irrigable areas are:—A nearly continuous chain of narrow strips of land on one or both banks of the Guadalquivir, from near its source to within about 30 kiloms. of Seville; a large area of the upper part of the valley near the confluence with the Guadalimar—the "Red River"—fed from a proposed reservoir of 500 million cubic metres capacity—17,650 million cubic feet—large areas on both banks between Seville and the sea.

*Water Power.*—It is estimated that the storage to be provided will justify the provision of power plants totalling 730,000 horse-power and having a normal maximum output of 550,000 horse-power, furnishing 2040 million kilowatt-hours per annum, or 560 million more than the present output.

## SIXTY YEARS AGO.

A HOTLY critical article on Mr. Isherwood, Chief Engineer of the United States Navy, and his works and ways as a responsible marine engineer appeared in our issue of September 18th, 1868. It was not by any means the first occasion on which we had criticised Mr. Isherwood, in whose genius as an engineer we, rightly or wrongly, could find little merit. Our feelings towards him were perhaps influenced by the none too friendly relations then existing between his country and ours. Britain was openly spoken of as the United States' next prospective enemy. Mr. Isherwood himself wrote on the subject without reserve. He desired to see his country in possession of a class of war vessel superior in speed to any other ocean steamer, one that could go to the British coast and "burn, sink and destroy every vessel of inferior force, naval or merchant, that might be found there." Nothing she pursued was to be capable of escaping from her, and nothing she fled from was to be capable of overtaking her. The more heavily armed but slower cruisers of the enemy were to follow her only by the flames of the burning wrecks which she left behind her. To fulfil this intention Mr. Isherwood produced the "Wampanoag." That vessel, in the opinion of everyone except Mr. Isherwood, was, so far as her hull was concerned, one of the sharpest and most beautiful vessels ever launched. But when she failed conspicuously to fulfil the Chief Engineer's intentions, Mr. Isherwood blamed her shallowness and narrow beam and the cramping effect which they had on his engines. Others, and we in particular, placed the fault wholly with the engines. In the article we have referred to we sought to show that much of Mr. Isherwood's failure was to be ascribed to his adoption of gearing between his engines and propeller. Such gearing, we said, had long ago been shown to possess no advantages and to have many disadvantages. The modern reader should note that there has been a complete reversal of ideas in the matter of geared marine engines. To-day gearing is used in order that the engines—turbines—may be run at a higher speed than that at which the propellers can work efficiently. Sixty years and more ago gearing was advocated and tried by some with the object of speeding up the propeller beyond the rate at which the engines could work with safety. In other words, gearing was employed not for speed reduction purposes, as it is now, but for speed increasing purposes. The advantages claimed for its use were that it enabled a fine-pitched screw to be used, reduced the wear and increased the life of the engines and facilitated the driving of the air pumps. We maintained that all these claims were fallacious, that fine-pitched screws possessed no particular advantages, that the largest engines ever made had been driven with safety and ease at 65 revolutions per minute—a speed quite fast enough for any screw—and that the air pump could be driven quite readily as fast as the steam piston, provided india rubber valves were used. Against the use of gearing we advanced the increased risk of breakdown and the increased weight and size of the machinery in the engine-room. In the "Wampanoag," we said, the engines had an overall length of 52ft. Had direct-acting engines been used the length need not have exceeded 20ft.

## Third-class Sleeping Cars.

THE interior appearance of the new third-class sleeping cars, arranged for both day and night service, which the London and North-Eastern Railway Company is putting in service on Monday, the 24th inst., is shown in the two engravings below. These cars, which have been built at the company's York works to the designs of Mr. H. N. Gresley, chief mechanical engineer, have bodies 61ft. 6in. long, 9ft. in width, and 12ft. 10in. high overall. They weigh 34 tons 10 cwt. each, and provide accommodation for twenty-eight passengers.

The underframes are of steel throughout and are carried

COMPARTMENT ARRANGED FOR DAY USE

on bogies of the compound bolster type. The automatic couplings and the vestibules are in accordance with the standard main line practice. The bodies, which are of teak and are varnished like other stock of the railway, are divided into seven compartments, each accommodating four passengers for sleeping, or the normal complement when the berths are shut up for the day. There is a corridor running the full length of the car, and the sliding doors leading to it can be locked from the inside if the passengers so wish.

There are four transverse berths in each compartment, and the upper ones are arranged to hinge downward into special fittings in the sides, while two safety slings clipped on to eyes in the roof sticks are provided as an added precaution against a sleeper rolling out of the berth. The

COMPARTMENT ARRANGED FOR SLEEPING

mattress is provided by the loose cushions, which during the day are used on the seat below, so that when the berth is folded up against the partition it does not protrude unduly. Access is obtained to the upper berths by an arrangement of the folding table, which enables it to be converted into a step ladder. To provide the lower berth, the seat is pulled out, and this action makes the cushioned back swing inwards, so that a comfortable width is provided to sleep on.

Accommodation for luggage is provided by a wide rack on one side and a recess above the corridor on the other. The window in the door and the centre window opposite are both balanced, and the outside one is fitted with a louvre ventilator. In addition, there are two torpedo ventilators in the roof of each compartment. The whole coach is lit electrically, and dim blue lights are arranged in the compartments, so wired that when the main lights are switched out the blue lights come on. The coach is heated on the "Non-Storage" system, and at each end there are separate toilet and closet compartments. The floors of these compartments are covered with brown rubber.

The length over the buffers of these coaches is 63ft. 6in., and the distance apart of the centres of the bogies 43ft. The wheel base of the bogies is 8ft. 6in. Each of the compartments measures 6ft. 4in. long by 6ft. 3¼in. wide; that is to say, the slightly smaller dimension is available for the length of the berths at night-time. The corridor is 2ft. wide.

## THE MODEL ENGINEER EXHIBITION.

THE Model Engineer Exhibition, which was opened—appropriately by a mechanical man—at the Horticultural Hall, Westminster, on September 15th, is the tenth of the series, and has grown to such an extent that we heard that it may have to be moved to "more commodious premises" next year.

In character the Exhibition closely resembles its predecessors, except perhaps that there is not quite the usual show of small machine tools, a fact which is accounted for, perchance, by the concurrent exhibition at Olympia. The display of models is, however, if anything, better than usual, and leads one to conjecture whether the reason is a waning of the interest taken in several temporary pastimes which have drawn amateurs away from their old hobbies, or that the campaign of the organisers in fostering the mechanical spirit of our youth is bearing more fruit. In this connection we would like to urge a still greater sympathy towards what might be described as engineering, rather than mechanical excellence in the models submitted for the competitions held in connection with the Exhibition. Modelling or copying is an excellent training, as it helps towards an appreciation of those principles of engineering which have been proved by long experience, while it forcibly teaches exactitude in workmanship. On the other hand, modelling does not help directly towards the development of new ideas, and it is by means of novelty that we must progress. Nevertheless, the models at the Exhibition are, without exception, very good, and some of them are excellent examples of how patience may overcome adverse working conditions. We will not attempt to single out any of the exhibits, as they all appeared to us to be of such nearly equal merit, although they range from a little double-cylinder oscillating steam engine which would stand on a threepenny piece, through locomotives modelled on a scale of 1½in., and steam turbines, to model anti-aircraft guns.

*Apropos* aircraft, there is an excellent display on the stand of the Royal Air Force, showing the work done by apprentices who are training to be aircraftsmen. The fitting of the specimen exercises, such as dovetails, and squares in square holes, is as good as would be expected in the highest class tool-room. The examples of woodwork are also very good.

Although, as we have said, some of the familiar machine tool makers are not represented this year, there are several stands devoted to the equipment of amateur workshops; but as we have in the past described most of the machines shown, it is unnecessary to enlarge upon them here. Taken altogether, the Exhibition is an excellent demonstration of enthusiasm on the part of both the organisers and the exhibitors. It closes to-morrow, the 22nd.

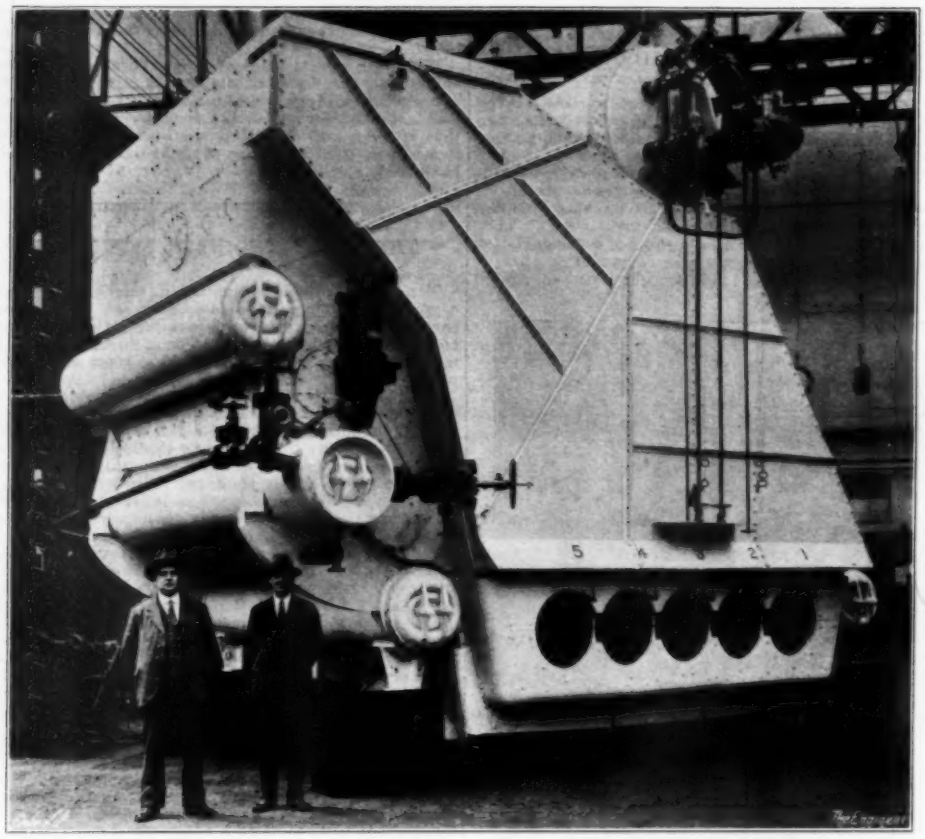
## BRITAIN AND AFRICAN MOTOR TRADE.

THE news that six of the principal British motor manufacturers are negotiating with a view to evolving a new car specially designed for the overseas market has been received in South Africa with great pleasure. This step should enable British manufacturers to find a magnificent market in the Dominions. South Africa offers a great field, for up to now there is only one motor car to every seventeen to eighteen Europeans in the country. In addition to providing a suitable car, though, it is indispensable that British manufacturers follow the American lead and establish an assembling factory at one of the ports, as the General Motors organisation has done. They, thereby, benefit by the decreased duty, while their employment of local labour will be a good advertisement in itself. It is stated that there is every likelihood of a big publicity campaign to push British cars being launched in South Africa shortly. If so it will have plenty of support as the desire to buy British goods is growing, and is shown in the increasing irritation at the Government's purchases of foreign locomotives, &c.

A COMMITTEE appointed by the engineering and shipbuilding section of the Royal Netherlands Institution of Engineers, to inquire into the desirability and financial possibility of a ship model testing tank in the Netherlands has issued its final report. The committee has found that shipbuilding firms and others are spending about 20,000 gls. per annum on model experiments, which have to be carried out in other countries through lack of appliances in Holland. An experimental tank of 525ft. free length, 30ft. width and 16ft. 6in. depth, with a car speed of 30ft. to 33ft. per second, is considered amply sufficient for all needs expected in the future. The total first cost, including building and plant, is estimated at 625,000 gls., and three large shipowning companies in the Netherlands, viz., Nederland Steamship Company, Rotterdam Lloyd and Koninklijke Paketvaart Maatschappij, have agreed to bear a share of 100,000 gls. each; the financial position of other shipowning and shipbuilding companies in the Netherlands, unfortunately, does not enable them to contribute materially to the capital cost of the undertaking, and approximately one-half of the capital required will have to be furnished by the Government.

P. & O. LINER VICEROY OF INDIA—HIGH-PRESSURE BOILER

YARROW AND COMPANY, LTD., SCOTSTOUN, ENGINEERS



## The Turbo-Electrically-Propelled P. and O. Liner Viceroy of India.

THE launch of the new 19,000-ton Peninsular and Oriental mail steamer "Viceroy of India," from the Linthouse yard of Alexander Stephen and Sons, Ltd., on Saturday last was an event of outstanding importance in the history of Clyde shipbuilding. It was appropriate that the new liner, which will be the largest in the P. and O. fleet, and the first turbo-electrically propelled passenger vessel to be constructed in Great Britain or Europe, should be launched from the same yard where twenty-four years ago one of the first steam turbine-driven passenger vessels, the Allan liner "Virginian," took the water.

The launching and naming ceremony was gracefully performed by Lady Irwin, wife of Lord Irwin, the present Viceroy of India, who was supported by Lord Inchcape, the chairman of the Peninsular and Oriental Steam Navigation Company, the shipbuilders, and a large company of friends.

The principal dimensions of the new liner may be summarised in the following table :—

*Hull Particulars.*

| | |
|---|---|
| Length overall | 610ft. |
| Breadth moulded | 80ft. |
| Depth moulded | 82ft. |
| Gross tonnage | 19,000 tons |
| Displacement, about | 25,000 tons |
| Fuel tanks | 22 tanks, total 2300 tons |
| Fresh water tanks | 14 tanks, total 1500 tons |

*Passenger Accommodation.*

| | |
|---|---|
| First-class passengers | 415 |
| Second-class passengers | 258 |
| Officers and crew, about | 400 |

*Propelling Machinery.*

| | |
|---|---|
| Number of main propelling motors | Two |
| Designed output each | 8500 S.H.P. |
| Normal running speed | 109 r.p.m. |
| Number of main alternators | Two |
| Designed output each | 9000 kW |
| Normal running speed | 2700 r.p.m. |

*Auxiliary Generator Sets.*

| | |
|---|---|
| Auxiliary turbo-generator sets | 4 at 500 kW |
| Auxiliary oil-electric generator sets | 2 at 165 kW |
| Emergency oil-electric generator set | 1 at 50 kW |

*Boiler Equipment.*

| | |
|---|---|
| Number of main boilers | Six |
| Designed working pressure | 350 lb./sq. in. |
| Total steam temperature | 700 deg. Fah. |
| Number of auxiliary boilers | Two |

All fired on the "Clyde" oil fuel burning system.

The lines of the vessel were decided upon after careful tests at the Froude National Tank, and the question of stability has been given special consideration. The hull is built to Lloyd's highest class, and the latest Board of Trade requirements, and it is subdivided into twelve water-tight compartments, which are again subdivided, so that there are more than sixty water-tight spaces, some of which are employed for oil fuel, fresh water, machinery and other purposes. The water-tight doors are operated from the bridge on the Scott-Ross all-electric system, separate control also being fitted to each door. Free use in the design has been made of fireproof bulkheads, and a Phomene fire-extinguishing plant is provided in the stokeholds, as well as the usual chemical, fire hose and water connections. The lifeboats are launched from Welin-MacLachlan type davits, and include fifteen lifeboats and one motor boat, in addition to life rafts. The navigation equipment is of the most up-to-date type, with Kelvin compasses and sounding machines and Siemens telegraphs. Directional wireless equipment is also carried. The steering gear is of the Brown electric-hydraulic type, and two 50 B.H.P. motors control the large balanced rudder. The capstan, windlass and 5-ton cargo winches are all of the Napier type, and are worked electrically on the "Austin" constant-current system. The refrigerating machinery for the 20,000 cubic feet spaces is supplied by J. and E. Hall, Ltd., of Dartford; and the "Thermotank" punkah-louvre system of ventilation is fitted in all the cabins and the public rooms.

The passenger accommodation is of the highest order, and in this ship a private cabin is to be provided for each saloon passenger. There are several notable public rooms.

The chief interest centres in the turbo-electric propelling machinery, which was designed and supplied by the British Thomson-Houston Company, Ltd., of Rugby, and particulars of which are given above. It comprises two B.T.H.-Curtis type steam turbine-driven alternators, which, when running at 2690 r.p.m., are each capable of delivering 11,600 S.H.P. at the propellers, which power with an average voyage displacement corresponds to a speed of 16½ knots. Under these conditions the ship will run with high economy and with one alternator set in reserve. The two main propelling motors are each designed for an output of 8500 S.H.P. at 109 r.p.m., and when both alternators are running at 3052 r.p.m., then the power developed by the motors will be 17,000 S.H.P., corresponding to a speed of about 18¾ knots on the same displacement.

The condensers are of the Weir regenerator type, which are underslung, and they are designed for a working vacuum of about 28in. of mercury, with air cooled water temperature of 82 deg. Fah. The air pumps are of the steam ejector pattern and are designed to work in a closed feed system incorporating motor-driven extraction pumps, turbo-feed pumps and three surface type heaters, which are arranged to give a feed temperature of 300 deg. Fah. The two main circulating pumps with their direct-coupled variable-speed motors were supplied by W. H. Allen, Sons and Co., Ltd., of Bedford.

The B.T.H. auxiliary turbo-generator sets are designed to work on superheated steam, and these sets, together with the oil-electric generator for use in port, will supply power for most of the engine-room and deck auxiliary machinery.

We show in the accompanying illustration one of the main Yarrow water-tube boilers. The six boilers are accommodated in two separate holds, which are water-tight compartments. The size of the boiler is such that when the vessel is steaming at 16½ knots it is expected that the after stokehold with its four boilers will suffice to supply all the steam required, thus enabling the two boilers in the forward stokehold to be closed down. In the forward boiler-room there are also two circular boilers reserved for port use.

The new liner is well advanced, both as regards her hull and propelling machinery, and it is expected that she will run her trials in February next.

---

THE extension of the overhead power transmission lines of Western Ontario is progressing at the rate of some three and a-half miles a day.

## Institute of Marine Engineers.*

By SIR ALAN G. ANDERSON, K.B.E.

IT is your custom to choose in turn as President a professional engineer and an ignoramus, and as last year you chose that distinguished engineer, Captain Onyon, you will not expect me to pretend to technical knowledge; but I do know that on your profession my trade of ships depends, and that without it the civilisation of the modern world could not have been built up. Just as your President is not always professional, so it seems to me the marine engineer is distinguished from other professional men. Generally the professional man differs from the trader, not only by his learning or by his dignity or his black coat, but still more because he may be supreme in his profession, a great thinker, and by his thought the father of enterprise, but in practice remote from the bread and butter troubles of the world. Not so the marine engineer. He must always keep one foot at least on a solid platform of fact. Half of him may theorise, but the other half must be a man of affairs controlling men and machines and money, disposing to the best advantage of strictly limited resources.

The chief engineer must at once satisfy himself and keep touch with a shipowner ashore and the captain afloat, but when the chief engineer is a fair sample of his profession the task of accommodating three distinct views without a clash is reduced from a complex to a simple problem. Here the professional man in the marine engineer steps forward. The "best" will satisfy him, and if the owner or captain want something else, they must, in fact, if not in form, argue their case before the professional judge, and sometimes the professonal must agree. The "best" may cost too much in time or money, and time and money spell risk in business and navigation, so that what seems the "best" may prove disaster. Professionally there is an absolute best, but in business the better may be the enemy of the good. It is sometimes urged in every business that the technical expert ought to take charge and as in the business of ships the marine engineer is an indispensable expert, more technical and more specially trained than any other officer afloat or ashore, ought he then to be supreme on the ship and on the same argument in the board room? The idea of expert control is attractive and is constantly being discovered afresh. Why should not the surgeon preside over the hospital, the civil servant be Chancellor of the Exchequer, the mechanical or civil engineer control the railway, and in our trade of the sea the marine engineer command the ship, and either he or the navigator become chairman of the shipping company? I don't myself agree with this theory of technical control, but to be fair to it, the command of ships seems to have moved away from amateur towards expert control.

Steamers began after Napoleon's wars. Sailing ships tonnage was still growing until after the Franco-Prussian war in 1870. The modern age of good food and cheap comfort which correspond with steam at sea is therefore scarcely yet one lifetime. The motor ship at sea and motor transport ashore will, to our successors, date their maturity from the end of yet another Great War, but the marine engineer accommodates himself to each change of engine and, if necessary, he will go aloft and navigate the air instead of the sea. The mechanical transport which began perhaps eighty years ago is not threatened by developments of to-day, but progress is hastened.

To show how fast and far we have moved in these last eighty years—in 1847 sailing ships carried almost the whole oversea trade of the world, 3,000,000 tons of sail in that year and less than 150,000 tons of steam. The population of the British Isles was then 27,000,000 and is now 45,500,000, an increase of 68 per cent. The great population of to-day is living notably better than the small population of eighty years ago. For a population that has not doubled we import nearly twenty times as much butter, to say nothing of other dairy products.

Each of our predecessors eighty years ago ate three foreign eggs in the year; to-day each of us eats eighty-four foreign eggs, as eggs or in buns, &c.

Of wool we are importing fourteen times as much as eighty years ago. If the steamer is responsible for the better living of the world it is responsible also for taking the population to, and the wool from, Australia and for halving the distance that separates that new continent from the world.

Eighty years ago we imported practically no meat, whereas last year we imported over 30 million hundredweight of meat.

Even the figures of an alleged decayed industry such as whaling are fairly large. We imported in 1927 of whale oil over 53,000 tons.

If anyone thinks that these figures simply mean that we are buying more abroad and producing less at home, let him consider luxury imports as a test of our standards of living. Sugar has risen from 34 lb. a head to 58 lb. a head and tobacco from 1·3 lb. to 5·8 lb., while even of wine—and our grandfathers are not supposed to have stinted themselves in wine—we import to-day more than double their imports.

So much for figures of comfort. The marine engineer does not claim the whole credit for this notable advance in the steam age. But, as the inventor lights up dark places, the marine engineer keeps the light burning and needs not only brains but the heart and understanding which make a happy ship and a successful business. Last year your President spoke about *personnel*. I touch no controversy when I say that every year as our mechanical knowledge improves the marine engineer grows in importance, relative and absolute. To be healthy a profession must reward its votaries. If the pay and position of the marine engineer do not keep pace with the marine engine, if the right men are not tempted to serve, the marine engine will suffer and not the engine alone. All of us depend on sea transport and we shall all suffer.

I have given you a few general figures to show the effect of the steam age on our comfort. Here are some technical figures. Forty years ago my firm chartered sailing ships for grain at rates 30 per cent. higher than are charged by a modern steamer to-day, and as each £ to-day is only worth about 11s. 6d. of forty years ago, the real comparison is

* Presidential address, delivered September 18th, 1928.—Abridged.

not between a rate of 35s. now and 46s. then, but between 20s. 1d. now and 46s. then. The difference in risk and time cannot easily be expressed in money, but imagine what the producer and underwriter and banker would say if they were told to-day that, instead of shipping in a steamer they must entrust their precious cargo or their lives to a clipper ship and pay more than twice as much for a voyage at about one-third the speed at a risk how much greater I hesitate to guess. To keep the prosaic steamer and avoid the romantic sailing ship there is no boon that the world would not gladly pay if the engineers of the world could hold the world to ransom. I suggest this merely as a test of the value of the marine engine and the marine engineer and not as a practical policy of blackmail.

You know better than I do how technical progress in engines at sea has gone ahead and prepared the way for less cost at less risk and more speed. In my lifetime the steam pressure has risen from the compound at 60 lb. per square inch to the triple at 120 lb. to 180 lb. per square inch, to the quadruple and the turbine at 215 lb. per square inch, and economy has kept step with and justified this technical progress. The indicated horse-power which cost 2 lb. to 2½ lb. of coal per hour in the old compound and 1¾ lb. in triple, 1¼ lb. in quadruple, has now gone down to little more than 1 lb. in geared turbine, and we watch with interest to see whether high-pressure steam with water-tube boilers and a consumption of 0·66 lb. of oil per shaft horse-power or the electric drive to link and get the best out of the fast turbine and the deliberate propeller or the internal explosion engine with consumption down to 0·4 per shaft horse-power hour will prove best in use.

Apart from the main engines it would shock the chief engineer of twenty years ago to see the electrical plant his successor of to-day handles. My first voyage to Australia was on the first Orient ship with electric light, and on rough nights it went out. Twenty years ago electricity was allowed to ring bells and light lamps, but was "uncertain, coy, and hard to please"—something feminine and scarcely fit for hard work. Now fans, hoists, winches, cooking, capstans, windlass—all these electricity takes in hand, and by this change the first cost of the ship has gone up and modern economy in fuel has been reached. By electricity and by the marine engineer who can keep this plant in order the engine has been revolutionised. If consumption has been divided by four or five the responsibility of the marine engineer has steadily risen and the men have as steadily risen to the occasion and fitted themselves for their new duties. These are the men and this is the profession for which your Institution speaks and over it I am proud to preside.

## American Engineering News.

### Chicago Sewage Treatment Works.

The largest of several sewage treatment plants being provided for sanitary disposal methods at Chicago is the West Side plant, which will treat the sewage from an area of about 100 square miles, being designed to serve a population of 1,850,000 and a flow of 400 million gallons daily. There will be three batteries of Imhoff tanks, each having thirty-six tanks 80ft. square and 35ft. deep, designed to give a detention period of two hours. The eight skimming tanks will be 105ft. long, 66ft. wide and 12ft. deep, providing a detention of fifteen minutes. Four grit chambers will be 90ft. long and 8ft. wide, with a depth of 6ft. The main pumping plant will consist of seven centrifugal pumps, two of which will have each a capacity of 100 cubic feet per second. They will be driven by 100 horse-power electric motors and have 48in. suction and 36in. discharge openings. The others will be of 200 second-feet capacity with 2000 horse-power motors, 54in. suction and 48in. discharge. All these pumps will operate against 68ft. head. For delivering sewage from the grit chambers to the Imhoff tanks there will be four centrifugal pumps of 30 second-feet capacity, with 75 horse-power motors. There will be motor-driven air compressors with an aggregate capacity of 6250 cubic feet per minute at 40 lb. pressure. This plant, of which the first portion is to go in service shortly, involved 300,000 cubic yards of excavation and the placing of 115,000 cubic yards of concrete.

### Electric Operation of Rolling Mills.

At a large tandem hot-strip rolling mill installed at Chicago the six finishing stands are driven by individual 2500 H.P., 600-volt, adjustable-speed, direct-current motors running at from 160 to 320 revolutions. Power is supplied by three 3000 kW motor-generator sets, one of which is used to start the six-roll motors by means of variable voltage control. In a still larger and more recent plant at Cincinnati, a similar mill has main-roll motors totalling 21,800 H.P., and including both alternating and direct-current motors. Each of the three intermediate stands is driven by a 2000 H.P. 600-volt motor at 300 to 600 revolutions, while each of the four finishing stands is driven by a 3000 H.P., 600-volt, adjustable-speed motor running at 180 to 360 revolutions. The main roll motors are supplied for three 4000 kW motor-generator sets and the auxiliary motors from two 750 kW sets, while all excitation is furnished from a 300 kW set. A third mill includes eleven main-roll motors of 400 to 1200 H.P., aggregating about 6500 H.P. With the high speed of delivery and the close spacing of the stands, special design was necessary to maintain correct speed relations between adjacent stands and thus prevent stretching or buckling of the metal due to varying speeds of rolls. A large cold strip mill has a special screw-down drive by which each screw can be motor driven independently, or both driven simultaneously by means of a magnetic clutch.

### Electro-chemical Protection of Boilers.

To prevent the corrosion of locomotive boilers in a district having very bad water, two railways have made experimental and successful use of an electro-chemical polarisation process. With this water, untreated, tubes fail in about five or six months by pitting. The positive pole of the headlight generator is connected to resistance coils and fuses in a box on the engine cab, from which box a connecting wire leads to two electrodes protruding through opposite sides of the boiler. Each electrode is connected to an insulated anode consisting of an iron pipe secured in place below the water surface. The negative pole of the generator is earthed to the boiler shell, so that the direct current flows through the resistances to the anodes and through the water to the immersed portions of the boiler shell and thence back to the negative pole of the generator. The resistances provide some 2 to 3 ampères to each electrode, giving 2 milliampères per square foot of protected surface. This current eliminates any electrolysis currents. But as the greatest amount of corrosion is due to galvanic action, the imposed current, in conjunction with an arsenic plating, maintains a protective film of hydrogen on the cathodic surfaces of the boiler. Arsenic is used on account of the ease with which it can be plated on iron, and its high discharge potential when hydrogen is plated upon it.

### Plumbing Research.

For sanitary and economic reasons a study of the hydraulic and pneumatic conditions of plumbing systems in houses and other buildings has been undertaken conjointly by the United States Department of Commerce and the University of Illinois. The study is of importance, not only for residences, but for large office buildings with numerous toilet rooms and the probable simultaneous discharge of several water-closets into the pipe system. While water-sealed traps prevent gases and vermin from entering by way of the drainage pipes, the protecting seal may be broken by the removal of the water due to air pressures either above or below atmospheric pressure. One object of the study was to discover some design or device to minimise the changes in pressure. Tests have been made to demonstrate the efficiency of various forms of traps to resist seal rupture through syphonage, self-syphonage and back pressure. Other tests have been made to determine the effectiveness of by-pass venting. Other tests are being made on water supply pipes and fixtures, the flow of water from taps, and the effectiveness of mixing valves in controlling the temperature of water from shower baths. With a battery of shower baths safety from scalding is best provided by mixing valves under the control of the bathers. Many mixing valves for baths and traps for closets were found to fall short of requirements and of their makers' claims.

## Provincial Letters.

### THE MIDLANDS AND STAFFORDSHIRE.

*(From our own Correspondent.)*

### Encouraging Features.

THE hopeful signs manifest of late in Midland industrial circles result in a bright market tone. Producers and consumers of iron and steel, eager to discern symptoms of better trading conditions, point to the steady advance of our export trade during the summer months, as recently revealed, as an excellent omen. The July relapse in the export of iron and steel has been followed by a rally, so that last month's turnover was larger than that of June, though the tonnage shipped was less. A most encouraging feature, however, is that the increase in exports last month, as compared with August, 1927, was almost entirely accounted for under the head of manufactured goods, the advance in this section being £2,443,462 over the comparable period of 1927. Exports of iron and steel went up in value from £5,366,105 a year ago to £5,941,852 last month, an increase of £575,747. Other outstanding rises were:—Vehicles, including locomotives, ships, and aircraft, £409,089; woollen and worsted yarns and manufactures, £416,489; machinery, £512,428. There was only one big decrease—non-ferrous metals and manufactures thereof declining by £260,502. The total quantity of iron and steel imported during the month was 272,368 tons, compared with 286,271 tons in the corresponding month of last year. For the year to date the quantity imported was 2,033,624 tons, valued at £16,763,169, compared with 3,192,803 tons and £24,540,936 in the preceding year.

### Enhanced Demand for Pig.

On the Iron and Steel Exchange in Birmingham to-day—Thursday—there was general agreement that demand for pig iron, especially foundry grades, is expanding, and in some circles it was considered that the current output of the blast-furnaces is now being absorbed. While there still remains an absence of forward contracting, consumers are placing a larger number of small orders to cover their immediate requirements. It would appear that the needs of the foundries are increasing, but no great accession of business is admitted by founders in this district. As regards the forges, some are idle, others are working intermittently, and very few have sufficient to ensure steady activity. Smelters adhere to late rates; tentative endeavours to stiffen the terms do not meet with encouragement. Derbyshire foundry is quoted £3; Northamptonshire, £2 15s. 6d.; North Staffordshire, £3 2s. 6d. Some small lots of East Coast hematite at £3 9s. to £3 10s. are coming into the district, and some Welsh hematite at £3 10s. has also been bought.

### Improved Steel Business.

The steel mills in the Midlands and Staffordshire are all in a better position, with the possible exception of plate rollers, who contend that their plant is idle owing to the inactivity at the shipyards. Mills rolling small bar, however, are doing much better, owing to the firmness of continental prices. English bars can be bought at £7 10s., whereas the continental maker quotes £7 2s. 6d. to £7 5s., and most of the business is being placed in this country, where prompt delivery can be obtained. Purchases of foreign steel are believed to be almost negligible at the moment, so far as this district is concerned, the advance of prices having left very little margin for importers to work upon. While the amount of foreign steel coming into the country remains considerable, it is steadily decreasing. Much of it is against old orders given out some time ago, and as these are worked out they are not being renewed. Continental quotations for 2in. billets this week were based upon £5 18s., at which figure they offered little attraction to consumers who have no difficulty in securing supplies locally at £6 2s. 6d. Mills producing joists and sections are pretty well off for orders, and are able to make a full week. Midland constructional engineers are using good quantities of this material, as they are getting a steady flow of orders and inquiries for building schemes. Foreign angles are quoted £7 2s. 6d., while British makers want £7 17s. 6d., less the rebate to those using exclusively native material. Ship, bridge and tank plates sell but slowly at £8 12s. 6d., but there is a better call for boiler plates at £11. Staffordshire hoops make £10 10s. at works. Works report a fair demand for steel strip, the price of which remains unchanged at £7 10s. per ton.

### Bar Iron Sales.

Sales of Staffordshire finished iron are much affected at the moment by the severe competition which users of this material are having to contend with. Darlaston makers of nuts and bolts complain strongly that the continental works not only send in the raw material in the form of bars, but are now flooding this market with finished bolts at prices with which they cannot possibly compete. A similar state of things exists in the tube trade of Walsall and Wednesbury. Finished tubes are coming in from Germany in enormous quantities, and this despite the fact that German tube strip now costs 2s. 6d. a ton more than English steel welded quality at £7 5s. a ton. Black Country manufacturers of nuts and bolts and of tube strip say it is almost impossible for them to secure orders against the foreigner, even though they utilise continental raw material. It would be an utter impossibility, they assert, for them to do so if they made up Staffordshire bars at nearly £2 per ton more than Belgian No. 3 iron, used for the same purpose. On 'Change in Birmingham this week, Belgian iron was quoted £7 2s. 6d. delivered, against the lowest Staffordshire figure of £8 15s. Many district mills ask £9 for this material. Makers of tubes say foreign tubes are being bought to such an extent that there is practically no demand for the native product. Indeed, it is reported that some Black Country tube manufacturers are themselves buying and selling again the foreign product, and that finished German tubes are coming into the works instead of raw material to be made up. Meanwhile, naturally, most of the plant is idle at these works. Staffordshire ironmasters find a fair call for best grade bars at £12 per ton. In this branch some stimulus has been given to business by specifications from the home railways. In the Crown bar department demand is fitful, and competition for the available business keen. Values show no sign of settling down and continue to range from £9 2s. 6d. to £10, according to make. Owing to the conditions ruling in the nut and bolt industry and to the difference in price of native and foreign material, little business is being done in nut and bolt iron at £8 15s. to £9 per ton, while the same may be said of iron strip. A large amount of rolling plant is reported as unemployed in this area.

### Galvanised Sheets.

The galvanised sheet branch continues very firm, and is apparently the strongest department of the market. There has been no falling off in the number of inquiries this week; as a matter of fact, South Africa and the West Indies have added their quota to the business in hand. South America and India are both buying well just now. The minimum price being asked at date for 24 gauge corrugated sheets is £13 10s., and many mills want from half a crown to 5s. above this figure. Some of the Midland mills are well placed for orders, but nearly all could do with more.

### Steel Scrap.

The all-round improvement in the steel industry has called for more heavy steel scrap for melting purposes, and the selling price has been advanced half a crown per ton to £3 10s. delivered South Wales. Holders refuse to do business at below this figure, which appears to have become the minimum.

### Production Decrease.

The lower output of iron and steel in August proved no more than producers and consumers here had anticipated. Indeed, surprise is expressed in some quarters that as much as 519,000 tons of pig iron should have been made in the existing state of demand. It is thought that some of the 25,200 tons of forge material produced is still at the furnaces awaiting purchasers, for sales, in this district at any rate, have been dull for some time past. The month's production, manufacturers see, included 164,700 tons of hematite, 193,400 tons of basic, 121,300 tons of foundry, and 25,200 tons of forge. The number of furnaces in blast, it is remarked, continues to decline, but a net reduction of one seems almost insignificant when we remember the talk of smelters and the statements that they must blow out furnaces and drastically curtail output. There are now 130 active furnaces throughout the kingdom, but it is doubtful if the whole of material they produce is being consumed. Industrialists in the Midlands note that while the production of steel ingots and castings last month—648,300 tons—was considerably below that of the previous month, it compared very favourably with the figure for the corresponding month last year, viz., 643,100 tons.

### Unemployment.

The unemployment position in the Midlands continues to show improvement, and a further reduction of 6247 in the number of workless has taken place during the past week. Whereas the latest return gives the total number of unemployed at 187,401, of whom 68,931 are stated to be only temporarily stood off work or are in casual work, the registered number before the August holidays was 202,909. Many branches of trade in the Midlands are now reported to be brightening up, and it is anticipated that even greater headway will be made during

the next month or so in the re-absorption of labour into district factories and workshops. Though on the week there have been slight increases at Derby, Dudley, Northampton, Oldbury and Wednesbury, the decline in such other areas as Birmingham, Stoke-on-Trent, Coventry, &c., have more than counterbalanced them. Of the total workless, 135,927 are men, 41,588 women, 4891 boys and 4995 girls.

## LANCASHIRE.

*(From our own Correspondents.)*

MANCHESTER.

### Foreign Trade in Textile Machinery.

EXPORTS of British-made textile machinery during August, although still on a satisfactory scale, are slightly below the monthly average of the January–August period of this year. Compared with the shipments during the corresponding month of the two previous years, however, exports during the period under review show up in a very favourable light. A marked decline in the Russian takings, bringing the shipments thence to an almost negligible level, probably more than accounts for the falling off in the value of the total exports during the month, although this has been counterbalanced to some extent by heavier shipments to Japan, a market which is likely to grow appreciably in importance to Lancashire and Yorkshire textile machinists. British India continues to buy on a consistently good scale, shipments during August amounting to £226,091. In order of importance Japan came next with £123,662, followed by Germany with £94,658; the Netherlands, £64,704; France, £64,307; South America, £60,896; China, £31,068; the United States, £26,843; Russia, £16,559; and Australia, £14,737; "other European countries" accounting for shipments of an aggregate value of £208,098. The total exports of textile machinery during the completed eight months of the present year, valued at £7,980,678, represent an increase of £522,000 compared with the corresponding period of last year, and of £1,328,000 compared with the eight months of 1926.

### The Industrial Outlook.

A somewhat more hopeful view of the situation in the engineering trade is taken by the Manchester Chamber of Commerce in the course of its monthly survey of general industrial conditions. The official organ of that body points out:—"Two Lancashire textile machinist companies who had been promised large orders for Russia have been visited by representatives of the Soviet Government, and it is understood that details of the work required have now been settled. Another piece of good news for the engineering trade is that the railway companies concerned are preparing to adopt electrification of the line between London-road Station, Manchester, and Altrincham, and that the work will be started this autumn. The distance to be dealt with is nine miles, but it is stated that this will only be a start, the ultimate intention being to form a loop, linking up with other lines of the same district. Some electrical engineers have received good orders for generating plant, and motor manufacturers are generally busy on cars or commercial vehicles. Locomotive builders have had a fair amount of work in hand, and some machine tool makers report increased business, although there are others who are not as fully engaged."

### Industrial Welfare Work.

Engineering interests will be well represented at the annual conference of the Institute of Industrial Welfare Workers, which is to open in Manchester on Friday of this week and will continue until Monday next, when such subjects will be discussed as "Health in Industry," "The Economic Value of Welfare Work," and "Co-operation in Industry." Mr. Charles Renold, of Hans Renold, Ltd., Manchester, is to preside at the session, at which the last-mentioned topic will be discussed, and a prominent part in the actual discussion will be taken by Mr. Sam Ratcliffe, who is chairman of the works committee of the Metropolitan-Vickers Electrical Company, Ltd., Trafford Park, Manchester.

### An Official Appointment.

Wigan Town Council has appointed Mr. W. F. Gardner, who was deputy borough engineer and water engineer of the town, to the position of borough engineer, at a salary of £650, rising to £800, in succession to Mr. R. B. Donald, who has been appointed city engineer at Belfast. In addition to Mr. Gardner, the "short list" of candidates for the position at Wigan included the names of Mr. H. P. Bishop, borough and water engineer, Bridgewater; Mr. W. H. Newton, borough and water engineer, Pontefract; and Mr. P. Parr, chief assistant in the city engineer's department, Liverpool.

### Non-ferrous Metals.

On the whole, fairly active conditions have been in evidence in most sections of the non-ferrous metals market during the past week, and whilst both lead and spelter are cheaper on balance, in copper and tin, and particularly in the latter, there has been a sharp rise. Buying interest in tin has not been unsatisfactory, and the statistical outlook is regarded as being of a fairly "bullish" nature. The advance in prices since my last report has more than wiped out the steady decline of the past seven weeks or so. Current values at the time of writing, with the exception of one period in the second half of July, are higher than they have been since the beginning of June. Firmness continues to characterise the copper section of the market, and a further rise in standard brands of the metal has been accompanied during the past week by an upward revision in the official quotations for refined descriptions. Current demand is on quietly steady lines, and is expected to broaden out. Both lead and spelter have declined a little, but in neither case are offers excessive, and the market seems to be anticipating a period of reasonably steady quotations.

### Iron and Steel.

If, up to the present, sellers of foundry iron have not yet experienced the autumn spurt in the demand from Lancashire users which they were hoping for, prospects appear to be brighter. Forward buying on this market, after the prolonged summer spell of dull conditions, is opening out a little, and deliveries against existing orders represent an improvement upon recent experience. If there is still room for a big improvement sellers this week are unanimous in saying that the present scale of business is appreciably better than it was in August. With regard to prices in the pig iron section, these keep steady, with Staffordshire and Derbyshire at from 67s. to 67s. 6d. per ton, Middlesbrough at 79s., Scottish from 87s. 6d. to 90s., according to brand, and West Coast hematite at about 82s. per ton, in each case including delivery to works in this area. Bar iron is quiet, with Lancashire Crown quality at £10 per ton and seconds at £9 10s. Constructional qualities of steel are moving off in fair aggregate quantities, and one or two good inquiries for boiler plates have been reported on this market during the past week. An improved trade is being done here in small re-rolled bars, due to a falling off in foreign competition as a result of the higher prices being quoted by continental mills. Sections are offered at £7 17s. 6d. per ton, general plates at £8 12s. 6d., frame plates at £8 17s. 6d., boiler plates at £9 12s. 6d. to £9 17s. 6d., and large bars at £8 17s. 6d. After a slight spurt a week ago in the demand for certain varieties of imported finished steel, business in this section has fallen flat again, although quotations all round remain distinctly firm.

BARROW-IN-FURNESS.

### Hematite.

There are signs of better business in the hematite pig iron market in the shape of more inquiries for deliveries. At present makers are not quite clearing their stocks, but the position is better than it was, and further demands will tend to bring the market into a more normal state than it has been for some time. As far as continental trade is concerned, there is not a great deal doing at present, but there are chances of improvement. America may also prove to be a better customer in the next few months than has been the case for some time. The demand for iron ore remains steady. Foreign ore is coming in in moderate tonnage. The steel trade is quiet, and Cumberland is only producing sleepers. At Barrow the rail and merchant mills are still engaged, and are likely to be until the end of next month.

## SHEFFIELD.

*(From our own Correspondent.)*

### Steel Trade Conditions.

HERE and there reports are a trifle more pleasing, and the demand for basic steel billets has been expanding ever since the rise in continental material began. Overseas business in railway steel is gradually improving. Trade continues quiet in the tool steel trade. In one or two cases orders for special heavy forgings are being executed, and there is a fair demand for cold rolled strip, whilst the cutlery and plate branches are receiving more inquiries on export account.

### Safeguarding.

In the meantime, representative leaders of industry are pressing for some measure of safeguarding to be accorded the heavy industries. In the bar iron trade, it is claimed, there is sufficient weight coming in from Belgium alone to keep fifteen or sixteen good-sized wrought iron works in this country fully employed, without any outside orders. It is practically impossible for the wire rod mills in England to compete with the continental mills, which are dumping wire rods into this country. Definite instances have been known of Germans charging £2 per ton less in the price f.o.b. continental ports for rods coming into this country than they are charging to the wire-drawers in Germany. All these rods are coming into this country free, whilst Germany imposes a prohibitive tariff on imported wire rods. One Sheffield firm, the Hardy Patent Pick Company, Ltd., has seized the occasion of the Prime Minister's appeal to employers to find employment for men and boys in the areas suffering from a depression of trade to send a straight letter to Mr. Baldwin. It points out that it is feeling the effect of the reduced consumption of coal through the reduced demand for tools, machinery, and other specialities it supplies for coal-mining. Consequently, instead of being able to take on fresh employees the firm is being compelled, greatly against its wish and interest, to dismiss men and place others on short time. "In our opinion," the writer says, "in the absence of other proposals for overcoming the exceedingly serious position into which the basic trades have fallen, the only solution is Protection." The chairman of the Sheffield Forge and Rolling Mills Company, Ltd., at the annual meeting, advocated safeguarding, without which, he said, the steel industry would go down. He questioned the right of the Premier to jeopardise, compromise, and mortgage the industry of this country simply to keep a pledge made at a time when he could know nothing of the conditions of industry to-day.

### Files for Spain.

The announcement of substantial increases which are to be made in the tariffs on files imported into Spain has been received with surprise, in view of the Spanish Ambassador's remarks on Sheffield's business relations with Spain, delivered in London last March. The Spanish Government, he explained, had authorised him to state that it was not its intention to impose heavier Customs dues on metal goods of any sort, or for the matter of that on coal. In view of this announcement it is regarded as peculiar that Spain should be intending to raise the duty on files from 56 to 250 pesetas per 100 kilos.

### Coal.

Varying conditions prevail among collieries in neighbouring counties, for whilst the pits at Staveley and Sheepbridge are making profits and many pits are restarting in Nottinghamshire, more Yorkshire collieries are closing down. Following the bad news concerning Rotherham Main comes the announcement that the notices of the whole of the 1000 employees at the Prince of Wales Colliery, Pontefract, have expired. Last March the company closed one seam to make for more economical working, and over 500 men then received notice, though most of them were subsequently absorbed in other parts of the colliery. The management justifies its present step by declaring that the pit has not for some time been paying, and this is supported by the fact that for many years the workings have not realised the minimum rent of £2500 per annum which is payable to the Pontefract Corporation, which owns the Park estate under which the seams mostly lie. Some years ago a new shaft to reach the Beeston seam was laid down, and this has now been completed, but operations at the coal face have been deferred until trade conditions improve. Many pits are resuming operations in Nottinghamshire, and with the exception of Blidworth and Tibshelf, men have gone back to work at all the pits. At Hucknall and Gedling full time is being worked, both Birchwood and Kirby pits have restarted, and the Wollaton and Radford collieries have not only taken back their own miners, but also found employment for forty-five others from Digby, New London, and Blidworth. It is further expected that Tibshelf will reopen again shortly, thus absorbing about 500 more men. Owing to restriction of supplies from the Yorkshire and Derbyshire coalfields, Grimsby trawler owners have been compelled to obtain coal elsewhere in order to augment the consignments arriving under the Five Counties Marketing Scheme. Contracts have been entered with Northern collieries which are not concerned in the marketing scheme for shipment of coal from Tyne ports to Grimsby.

### Leeds University.

The ceremony of laying the foundation stone of the new buildings of Leeds University will take place on October 2nd. The stone to be laid will actually be in the new building of the mining department, which will be the first to be completed under the £500,000 scheme inaugurated in 1925. The plans provide for the better housing of the library, and the mining, physics, chemistry, mathematics, botany, English, and law departments.

## NORTH OF ENGLAND.

*(From our own Correspondent.)*

### Tees Shipbuilding Record.

A NEW record for Tees shipbuilding has been established by the Furness Shipbuilding Company, at Haverton Hill, by the launching of the biggest vessel that has occupied a slipway in the river. The vessel, the "Calgarolite," is an oil tanker of nearly 16,000 tons deadweight, and is being built for the Imperial Oil Company, of Toronto. All the previous vessels ordered by this company were built in German shipyards, and it is to the credit of the Tees firm that it was able to secure the order. The "Calgarolite" has the following dimensions:—Length, 542ft.; breadth, 70ft. 6in.; depth, 38ft. 9in. to the upper deck. It will be capable of 12 knots per hour. Krupp engines are to be installed. The "Calgarolite" is in every sense a luxury ship. The captain's quarters include a light oak-panelled bedroom, hall, and oak-framed sitting-room, private bathroom, and an office mahogany-framed and excellently equipped. The crew have two-berthed cabins, and each bed has its own reading lamp—a thoughtful provision made by the owners, so that one watch does not disturb the other. Another interesting feature of the shipbuilding industry on the Tees is the completion and sailing this week of two large vessels which have been converted into floating whale factories fitted with the most up-to-date plant. One is the "Southern Empress," originally an oil tanker, and the other the former passenger liner "Athenic." The vessels have been specially transformed for dealing with whales in the open sea. In each case a hole has been cut out of the stern, and a slipway rising from the water at a convenient angle to the deck has been introduced. By this means a whale can be hauled with comparative ease from the sea, up the slipway, and on to the deck. The whales will be cut up by machinery, and the blubber will be conveyed down chutes to the boilers. In the "Athenic" there are tanks capable of holding 12,000 tons of oil.

### Cleveland Iron Trade.

Conditions in the Cleveland pig iron trade continue to improve. Not yet do they warrant a great deal of assumption, but the signs of a revival are, on the whole, distinctly favourable. Very little Cleveland pig iron is available for the open market, due to an increased absorption at the steel works, where operations are more active than for some months past. It is understood that another blast-furnace is to be put into operation in the near future, with a view to augmenting the present very limited supplies finding access to the open market. At the same time there is a good deal of scrap being used in local steel works. What is most wanted is some improvement in the export trade, although the amount of inquiry indicates a chance of some stimulus from this direction. Cleveland makers are still encountering in certain quarters a fair amount of competition by Midland firms, but generally speaking they are securing a fair share of the trade that is being placed. The position all round is more encouraging. Enlargement of local consumption is assured, and home users elsewhere are expected to accept increased deliveries, while there is promise of better business with Scottish consumers. Quotations are very firm, No. 1 Cleveland foundry iron being 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; and No. 4 forge, 64s. 6d.

### Hematite Pig Iron.

Continued slow but steady expansion of business in the East Coast hematite pig iron trade is encouraging. Prices obtainable are still well below cost, but are moving

in the right direction. Further sales to home and continental customers are reported, and inquires keep on a fairly good scale. Stocks have been reduced to proportions no larger than are needed to carry on ordinary business, and with the make insufficient to cover fully home and foreign demand, purchases can no longer be made at the low figures which have ruled for some months past. Makers are still unable to arrange contracts except on unremunerative terms, but they have turned down orders at 69s., and considerably over 70s. has been realised for superior qualities.

**Ironmaking Materials.**

Continued absence of foreign ore consumers from the market does not disturb merchants, who confidently predict a shortage of supply, and adhere firmly to recent quotations. Nominally, market rates remain on the basis of best Rubio at 22s. 6d. c.i.f. Tees. Demand for blast-furnace coke keeps light, but producers state they have not much to offer for early delivery, and that a speedy return to anything like normal requirements would be difficult to cope with. Good average kinds are in the neighbourhood of 17s. 6d. delivered to works in this district.

**Manufactured Iron and Steel.**

Conditions in the manufactured iron and steel trade are daily becoming more active. Some improvement in the sale of manufactured iron is reported, and business in both semi-finished and finished steel is on a better scale. Customers who have been taking continental products are now buying in this area, and expansion of transactions is not confined to business with home firms. Recent sales include parcels for customers at a great distance. Railway material is in much better request than of late, and steel for constructional engineering work is selling fairly well; while specifications for shipbuilding requisites are being distributed somewhat less sparingly than for some time. Sheet producers are very busy, and are sold to the end of the year. Quotations all round are steady.

**The Coal Trade.**

The proposed conference between English and Polish coalowners on the question of minimising competition between the two countries is of special interest to the Northern coal trade. Whether anything comes of the discussions remains to be seen, but there is a feeling in Northumberland and Durham that now British coal is winning back the export trade lost through stoppages, it should continue untrammelled to work out its own salvation. Poland is feeling this competition, but is keen to hold the export trade it has secured in the last four years. There is no special movement in the steam coal section. The general outlook remains dull, and whilst individual positions change from day to day, in no instance is there any definite improvement noticeable over a period. Buyers seem to confine their commitments to immediate deliveries, and whilst fitters offer freely for any period over the next three to six months at current prices, consumers show little or no interest. Best Blyth steams are 13s. 6d., and second steams 12s. Gas coals are languid in respect of all qualities, and producers are still waiting for the delayed seasonal activity. The cooler weather is coming, and it will quickly be reflected in the demand for gas sorts generally. There is considerable variation in the individual position of pits, so far as orders are concerned, but the broad fact is that Durham is passing through a very lean time, and any accession of trade through early winter needs would be exceedingly welcome. The quotation for best gas coals is unchanged at 14s. 9d. The demand for all grades of coke is good. It seems that more and more foundry coke is being used abroad for central heating purposes, and this, with the ordinary manufacturing requirements, is sustaining a brisk export trade. Full late prices are maintained, and there is no surplus for prompt. Forward, the inquiries are quite satisfactory, and the early winter promises a good outlet for coke. Gas coke is quoted at 19s. 6d. to 20s.; patent oven cokes, 18s. 6d. to 19s.; beehive and other special cokes, 23s. to 28s.

## SCOTLAND.

*(From our own Correspondent.)*

**Electricity Scheme: First Spans Completed.**

THE first stage in the Government's scheme to provide cheap electrical power has been concluded with the completion of the first spans on the eighteen miles section between Bonnybridge and Clydesmill. The Scottish portion of the scheme embraces the linking up and unification of the main generating stations in the valleys of the Clyde, Forth, and Tay, thereby covering the principal shipbuilding, engineering, colliery and manufacturing areas of Scotland. In this area forty-two existing power companies and municipal installations will ultimately be absorbed.

**Steel and Iron.**

No important change is shown in the general trend of business in the steel and iron trades. The steel works are booking a fair number of orders, and inquiries from abroad are said to be improving. Sections and plates have a steadier demand. A considerable proportion of the plants is still out of action, but makers are now taking a more hopeful view of the situation, in view of the continued firmness of continental prices. Steel sheets are busy, especially the lighter gauges, and galvanised sheets have a steady turnover. The tube trade is active. Bar iron is dull. Re-rolled steel bars are active, but the position is not improving with the appreciation in foreign billets. Business in pig iron is unsatisfactory, and prices are just steady. Scrap materials have been a shade more active, with heavy steel quoted at 65s., and cast iron scrap at 62s. 6d. per ton.

**Exports and Imports.**

During the past week 16,000 tons of iron ore, 3300 tons of pig iron from India, and 1400 tons of steel and iron from the Continent were discharged at Glasgow harbour. Shipments included 4500 tons of steel and iron materials and 363 tons of pig iron.

**Coal.**

Business in the Scottish coal trade continues on recent lines, and there is, as yet, no indication of an early improvement. Home demands are only moderate, and with supplies fairly plentiful, the collieries have difficulty in securing an advance in prices which they have been endeavouring to realise since the beginning of this month. Inquiries from abroad are very slow, and in this respect the Scandinavian countries are especially disappointing. Exporters, for the most part, still confine their operations to buying small lots necessary to complete old contracts. Round coals, as a rule, are plentiful, but an exception is found in Lanarkshire ells, for which as much as 15s. 6d. per ton is now quoted. Scottish collieries have intimated an increase of 1s. per ton in the price of coal for the Irish market. Aggregate shipments amounted to 280,330 tons against 262,455 tons in the preceding week, and 244,432 tons in the same week last year.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

**Coal Trade Conditions.**

THE conditions in the steam coal industry of this district have not turned out during the past week quite as well as expected. It was not thought that there was going to be an immediate improvement of a marked character, but still it was believed that there would be better working and more active shipments. It is quite true that for the week ending the 14th inst. the returns of exports were 407,600 tons, as against 362,395 tons for the preceding week, but, as a matter of fact, this small increase is disappointing. A much higher level of shipments is required to bring about a real improvement in the general situation. The chief trouble is that tonnage has not been available for the collieries, so that although they may be fairly well sold on paper they are still experiencing difficulty in securing a ready outlet for their coals. The freight market has gone against merchants in some directions, and the position is that those with c.i.f. contracts to carry out have been deferring the chartering of tonnage in the hope that rates of freight might come back to some extent. The taking up of tonnage cannot be postponed indefinitely, but delay to charter very soon causes inconvenience to collieries. The fact that collieries have not been so well placed for tonnage is shown by the total of idle loading appliances at the end of last week. The total came to forty-two, but as the result of arrivals of steamers over the week-end the number of idle tipping appliances was reduced to twenty-six on Monday last. This figure is too high, as it means that numerous collieries must have a substantial amount of coal standing, and irregularity of employment at pits. Some of the leading coals have been in a fairly comfortable position, but inferior grades have been very short of orders. So far as new inquiry is concerned, there appears to be slightly more about. The Portuguese State Railways have asked for offers for 100,000 tons of small coals for delivery from mid-October to mid-February, with the option of taking a further 100,000 tons for delivery over the succeeding three months. It is also reported that the P.L.M. and the French Midi Railways, which for some time past have been taking German coals, are likely to be in the market for offers of Welsh qualities.

**Welsh Ports Traffic.**

The returns of traffic at South Wales Ports under the control of the G.W.R. Company for the four weeks ended September 2nd were unfavourable when compared with the figures for the preceding month. The reduction of traffic amounted to 329,000 tons, as the total came to only 2,414,201 tons. The August holidays may, of course, account for the falling off. Imports which in the previous four weeks touched the highest level for the whole of this year, dropped by 41,000 tons to 390,622 tons. Exports also declined by 288,000 tons to 2,023,579 tons. Taking the whole of this year to September 2nd, the import and export trade amounted to 23,421,419 tons, as against 25,984,582 tons in the corresponding period of last year. Imports fell from 4,165,050 tons to 3,378,123 tons, and exports marked a reduction from 21,819,532 tons to 20,043,296 tons, of which coal and coke accounted for 17,758,728 tons, a decrease of 1,500,000 tons.

**Miscellaneous Items.**

Normal employment was resumed on Monday at the Dowlais Iron and Steel Works, at Dowlais, where about 2000 of the 4000 men usually engaged have been idle for a week as the result of temporary depression in the steel trade. Fire caused damage running to several thousand pounds at the Ystalfera Tin-plate Works on Monday last, and about 300 men will be thrown out of employment for about six weeks to two months. Notices were issued on Saturday last to about 1500 men employed at the Naval collieries, which are in the Cambrian Combine, and which are situated at Tonypandy and Penygraig. It is possible, however, that the men will continue to be engaged on day-to-day contracts.

**Welsh-American Tin-plate Pact.**

Mr. H. C. Bond, managing director of Richard Thomas and Co., returned from the United States on Friday of last week, and was due to lay before a meeting of the Welsh Plate and Sheet Manufacturers' Association at Swansea on Tuesday his report on the conversations which have been taking place between Welsh and American tin-plate producers for a division of the world markets. Mr. Bond stated immediately upon his arrival that no agreement had as yet been signed, though a provisional agreement had been come to, and there was a chance of it going through. He made it clear that there was to be no price agreement, but that the arrangement was purely one of the allocation of the markets. He denied that under the arrangement America would secure the Canadian market. As a matter of fact, under the agreement South Wales should do more business in Canada than it has ever done in the past. He expressed the view that South Wales would benefit under the scheme, though he would not say that the suggestion that Welsh makers should increase their potential sales by about 1,000,000 boxes per annum was correct.

LATER.

At a meeting of the tin-plate conference at Swansea on Tuesday afternoon it was unanimously resolved to approve the proposed agreement with American manufacturers. Mr. H. C. Bond, the President, made a report on his recent visit to America. An official report of the meeting states that the agreement aims at securing a reasonable division of the export trade available from Great Britain and the United States. It does not carry with it any price arrangement nor does it hand over to the United States any markets which are now being supplied by Welsh tin-plate manufacturers. It does not propose to alter the existing channels through which business is being done by manufacturers. The agreement should be of benefit to all connected with the Welsh industry, including merchants interested in that business. The meeting appointed a committee to explain the terms of the agreement to a representative body of tin-plate merchants.

**Current Business.**

There has not been much business passing for prompt loading, the main difficulty of exporters being at the moment to secure tonnage which can give early readiness. The tone of the market generally displays irregularity, though in the case of one group of superior coals an effort has been made to obtain 3d. more than has lately been paid. Prices for the most part have ruled round about the minimum for most descriptions of large. Sized descriptions and smalls have kept firm, and in the case of the latter salesmen have asked for an advance of 3d. per ton for supplies if no large coals are bought at the same time. Coke and patent fuel have continued quiet, but pitwood has ruled very steady at 29s. 6d. to 30s.

## PERSONAL AND BUSINESS ANNOUNCEMENTS.

WILLIAM PRESS AND SON, civil engineering contractors, have removed to 38, Old Queen-street, Westminster, S.W. 1.

MR. H. E. METCALF has resigned his position with Messrs. Babcock and Wilcox to become general manager of Ruths Steam Storage, Ltd.

MR. H. J. YOUNG announces that he has taken into partnership Mr. George Shaw, M.Sc. (Durham), and he is now practising with him under the style of Young and Shaw, analytical and consulting chemists, at 497A, Shields-road, Walker Gate, Newcastle-on-Tyne.

BURN TRANSMISSIONS, Ltd., Longparish, Hants, have recently acquired new shops and installed special plant for the manufacture of all types of "Burn" Transmissions. The inventor, Mr. Lewis Burn, and the staff engaged in the design and production of this transmission system for some years, will be responsible for the administration and activities of the new company, and inquiries should in future be sent to the above address or to the London Office, Clutha House, 10, Princes-street, Westminster, S.W. 1.

BOSTOCK AND BRAMLEY, Ltd., inform us that following the recent merging of important engineering interests, they have entered into a close working agreement with Craven Brothers (Manchester), Ltd., whereby the manufacture of their gearing will, in future, be carried out at their Vauxhall Works, Reddish. The obligations of Joshua Buckton and Co., Ltd., in respect to their gearing, have been assumed by Craven Brothers (Manchester), Ltd. A special self-contained building has been set apart for this work, and is manned by the existing *personnel*. The firm's new address is Vauxhall Works, Reddish-road, Reddish, Stockport.

## CONTRACTS.

THE GENERAL ELECTRIC COMPANY, Ltd., has received an order from the Exeter Corporation Tramways for four complete tramcar electrical equipments. Each car will be equipped with two motors, each rated at 50 H.P. on the one hour rating, 500 volts, and two series-parallel controllers.

## LAUNCHES AND TRIAL TRIPS.

MAJANG, motor ship; built by "De Maas" Shipbuilding Company, Ltd., to the order of the Royal Packet Company; dimensions, length, 165ft.; breadth, 28ft. 8in.; depth, 10ft.; 400 tons deadweight. Engines, 250 horse-power Sulzer; launch, September 4th.

PORT ALMA, twin-screw motor cargo ship; built by Swan, Hunter, and Wigham Richardson, Ltd., to the order of the Commonwealth and Dominion Line, Ltd.; dimensions, length, 500ft.; breadth, 63ft. Engines, Doxford opposed-piston type; launch, September 11th.

CORYTON, steamship; built by Wm. Gray and Co., Ltd., to the order of Sir J. Herbert Cory, Bart.; dimensions, length, 412ft. 6in.; breadth, 33ft.; depth, 35ft. 1¼in. Engines, triple-expansion, 26in., 42in. and 70in. diameter by 48in. stroke; pressure, 180 lb. per square inch; trial trip, September 12th.

FINNANGER, motor tank ship; built by the Netherland Shipbuilding Company, to the order of Westfal, Garsen and Co. A/S; dimensions, 493ft. 6in. long, 64ft. 3in. broad, and 36ft. 6in. deep; 13,600 tons. Engines, two four-cycle, single-acting Werkspoor Diesel, 26½in. diameter by 47¼in. stroke; 4540 I.H.P.; trial trip, September 12th.

SEATRAIN, single-screw steamship; built by Swan, Hunter, and Wigham Richardson, Ltd., to the order of Overseas Railways, Inc.; dimensions, length, 427ft. 6in.; breadth, 21ft. 3in.; 7000 tons deadweight. Engines, triple-expansion; launch, September 13th.

CREOLE JEFE, twin-screw oil tank steamer; built by Palmer's Shipbuilding and Iron Co., Ltd.; 4000 tons of oil. Engines, triple-expansion.

# Current Prices for Metals and Fuels.

## IRON ORE.

| | |
|---|---|
| N.W. COAST— | |
| (1) Native | 18 6 to 21/6 |
| (1) Spanish | 18 6 to 22/6 |
| (1) N. African | 18 6 to 22 6 |
| N.E. COAST— | |
| Native | 18/- to 21/- |
| Foreign (c.i.f.) | 22/6 |

## PIG IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| (2) SCOTLAND— | | |
| Hematite | 3 14 0 | — |
| No. 1 Foundry | 3 15 0 to 3 16 0 | — |
| No. 3 Foundry | 3 11 0 | — |
| N.E. COAST— | | |
| Hematite Mixed Nos. | 3 10 0 | 3 10 0 |
| No. 1 | 3 11 0 | 3 11 0 |
| Cleveland— | | |
| No. 1 | 3 8 6 | 3 8 6 |
| Silicious Iron | 3 8 6 | 3 8 6 |
| No. 3 G.M.B. | 3 6 0 | 3 6 0 |
| No. 4 Foundry | 3 5 0 | 3 5 0 |
| No. 4 Forge | 3 4 6 | 3 4 6 |
| Mottled | 3 4 0 | 3 4 0 |
| White | 3 4 0 | 3 4 0 |
| MIDLANDS— | | |
| (3) Staffs.— | | |
| All-mine (Cold Blast) | — | — |
| North Staffs. Forge | — | — |
| ,, ,, Foundry | 3 2 6 | — |
| (3) Northampton— | | |
| Foundry No. 3 | 2 15 6 to 2 17 6 | — |
| Forge | 2 12 6 | — |
| (3) Derbyshire— | | |
| No. 3 Foundry | 2 19 0 to 3 0 0 | — |
| Forge | 2 16 0 | — |
| (3) Lincolnshire— | | |
| No. 3 Foundry | 2 19 0 | — |
| No. 4 Forge | 2 17 6 | — |
| Basic | 2 19 0 | — |
| (4) N.W. COAST— | | |
| N. Lancs. and Cum.— | | |
| Hematite Mixed Nos. | 4 2 0 (a) / 4 4 6 (b) / 4 8 0 (c) | — |

## MANUFACTURED IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| SCOTLAND— | | |
| Crown Bars | 10 5 0 | 9 15 0 |
| Best | — | — |
| N.E. COAST— | | |
| Iron Rivets | 11 5 0 | — |
| Common Bars | 10 5 0 | — |
| Best Bars | 10 15 0 | — |
| Double Best Bars | 11 5 0 | — |
| Treble Best Bars | 11 15 0 | — |
| LANCS.— | | |
| Crown Bars | 10 0 0 | — |
| Second Quality Bars | 9 10 0 | — |
| Hoops | 13 0 0 | — |
| S. YORKS.— | | |
| Crown Bars | 10 10 0 | — |
| Best Bars | 11 0 0 | — |
| Hoops | 12 10 0 | — |
| MIDLANDS— | | |
| Crown Bars | 9 2 6 to 10 0 0 | — |
| Marked Bars (Staffs.) | 12 0 0 | — |
| Nut and Bolt Bars | 9 15 0 to 9 0 0 | — |
| Gas Tube Strip | 10 15 0 to 10 17 6 | — |

## STEEL. (*d*)

| | (6) Home. £ s. d. | (7) Export. £ s. d. |
|---|---|---|
| (5) SCOTLAND— | | |
| Boiler Plates | 10 10 0 | 10 10 0 |
| Ship Plates, ½in. and up | 8 7 6 | 7 12 6 |
| Sections | 7 17 6 | 7 2 6 |
| Steel Sheets, ½in. | 8 15 0 | 8 12 6 |
| Sheets (Gal.Cor. 24 B.G.) | 13 10 0 | 13 10 0 |

## STEEL (*continued*).

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| N.E. COAST— | | |
| Ship Plates | 8 7 6 | — |
| Angles | 7 17 6 | — |
| Boiler Plates | 12 15 0 | — |
| Joists | 7 17 6 | — |
| Heavy Rails | 8 10 0 | — |
| Fish-plates | 12 0 0 | — |
| Channels | 10 5 0 | £9 to £9 5 |
| Hard Billets | 7 12 6 | — |
| Soft Billets | 6 15 0 | — |
| N.W. COAST— | | |
| BARROW— | | |
| Heavy Rails | 8 5 0 | — |
| Light Rails | 8 10 0 to 8 15 0 | — |
| Billets | 7 10 0 to 10 0 0 | — |
| MANCHESTER— | | |
| Bars (Round) | 8 17 6 | — |
| ,, (Small Round) | 7 15 0 to 8 0 0 | — |
| Hoops (Baling) | 10 0 0 | 9 15 0 |
| ,, (Soft Steel) | 9 0 0 | 8 15 0 |
| Plates | 8 12 6 to 8 17 6 | — |
| ,, (Lancs. Boiler) | 9 12 6 to 9 17 6 | — |
| SHEFFIELD— | | |
| Siemens Acid Billets | 10 0 0 | — |
| Hard Basic | 7 2 6 and 7 12 6 | — |
| Intermediate Basic | 7 0 0 | — |
| Soft Basic | 6 5 0 to 6 7 6 | — |
| Hoops | 9 0 0 | — |
| Soft Wire Rods | 7 5 0 to 7 10 0 | — |
| MIDLANDS— | | |
| Small Rolled Bars | 7 7 6 to 8 0 0 | — |
| Billets and Sheet Bars | 6 2 6 | — |
| Sheets (20 W.G.) | 11 10 0 to 12 0 0 | — |
| Galv. Sheets, f.o.b. L'pool | 13 10 0 to 13 12 6 | — |
| Angles | 7 17 6 | — |
| Joists | 7 17 6 | — |
| Tees | 8 17 6 | — |
| Bridge and Tank Plates | 8 12 6 | — |
| Boiler Plates | 11 0 0 | — |

## NON-FERROUS METALS.

| | |
|---|---|
| SWANSEA— | |
| Tin-plates, I.C., 20 by 14 | 18/- to 18/4½ |
| Block Tin (cash) | 215 0 0 |
| ,, (three months) | 212 7 6 |
| Copper (cash) | 63 11 3 |
| ,, (three months) | 64 2 6 |
| Spanish Lead (cash) | 22 2 6 |
| ,, (three months) | 21 16 3 |
| Spelter (cash) | 24 10 0 |
| ,, (three months) | 24 12 6 |
| MANCHESTER— | |
| Copper, Best Selected Ingots | 68 0 0 |
| ,, Electrolytic | 71 0 0 |
| ,, Strong Sheets | 94 0 0 |
| ,, Tubes (Basis Price), lb. | 0 1 1½ |
| Brass Tubes (Basis Price), lb. | 0 1 0 |
| ,, Condenser, lb. | 0 1 2 |
| Lead, English | 23 15 0 |
| ,, Foreign | 22 5 0 |
| Spelter | 24 15 0 |
| Aluminium (per ton) | £107 |

## FERRO ALLOYS.

| | Per Ton. | Per Unit. |
|---|---|---|
| Tungsten Metal Powder | 1/7 per lb. | |
| Ferro Tungsten | 1/3 per lb. | |
| Ferro Chrome, 4 p.c. to 6 p.c. carbon | £21 10 0 | 7/6 |
| ,, ,, 6 p.c. to 8 p.c. ,, | £20 10 0 | 7/- |
| ,, ,, 8 p.c. to 10 p.c. ,, | £20 0 0 | 6/- |
| ,, ,, Specially refined | | |
| ,, ,, Max. 2 p.c. carbon | £33 0 0 | 12/- |
| ,, ,, ,, 1 p.c. carbon | £37 0 0 | 15/- |
| ,, ,, ,, 0·70 p.c. carbon | £41 0 0 | 17/- |
| ,, ,, ,, carbon free | 1/- per lb. | |
| Metallic Chromium | 2/7 per lb. | |
| Ferro Manganese (per ton) | £13 15 0 for home<br>£13 10 0 for export | |
| ,, Silicon, 45 p.c. to 50 p.c. | £12 0 0 scale 5/- per unit | |
| ,, ,, 75 p.c. | £19 0 0 scale 6/- per unit | |
| ,, Vanadium | 14/- per lb. | |
| ,, Molybdenum | 4/- per lb. | |
| ,, Titanium (carbon free) | 1/2 per lb. | |
| Nickel (per ton) | £175 | |
| Ferro-Cobalt | 9/- per lb. | |

## FUELS.

### SCOTLAND.

*(Prices not stable.)*

| | Export |
|---|---|
| LANARKSHIRE— | |
| (f.o.b. Glasgow)—Steam | 13/9 |
| ,, ,, Ell | 15/6 |
| ,, ,, Splint | 16/- to 17,- |
| ,, ,, Trebles | 13/3 |
| ,, ,, Doubles | 13/- |
| ,, ,, Singles | 12/- |
| AYRSHIRE— | |
| (f.o.b. Ports)—Steam | 13/6 |
| ,, ,, Jewel | 15/6 |
| ,, ,, Trebles | 13/6 to 13/9 |
| FIFESHIRE— | |
| (f.o.b. Methil or Burntisland)—Steam | 11/- to 12/9 |
| Screened Navigation | 18/- |
| Trebles | 14/- to 14,6 |
| Doubles | 13/6 to 13/9 |
| Singles | 12/6 |
| LOTHIANS— | |
| (f.o.b. Leith)—Best Steam | 12/3 |
| Secondary Steam | 11/9 |
| Trebles | 13/6 |
| Doubles | 13/3 |
| Singles | 12/6 |

### ENGLAND.

| | |
|---|---|
| (8) N.W. COAST— | |
| Steams | 24/- to 25/- |
| Household | 37/6 to 50/- |
| Coke | 22/6 to 23/6 |
| NORTHUMBERLAND— | |
| Best Steams | 13/3 to 13/6 |
| Second Steams | 11/9 to 12/- |
| Steam Smalls | 9/- to 9/6 |
| Unscreened | 11/9 to 12/- |
| Household | 21/- to 27/- |
| DURHAM— | |
| Best Gas | 15/- |
| Second | 13/3 to 13/9 |
| Household | 21/- to 27/- |
| Foundry Coke | 18/3 to 19/- |

| SHEFFIELD— | Inland. |
|---|---|
| Best Hand-picked Branch | 26/- to 27/6 — |
| Derbyshire Best Bright House | 21/- to 22/6 — |
| Best House Coal | 19/6 to 20/6 — |
| Screened House Coal | 16/- to 17/- — |
| ,, ,, Nuts | 14/- to 16/- — |
| Yorkshire Hards | 14,6 to 16/- — |
| Derbyshire Hards | 14,6 to 16/- — |
| Rough Slacks | 8/6 to 9/6 — |
| Nutty Slacks | 4,6 to 6/- — |
| Smalls | 3/- to 4/6 — |
| Blast-furnace Coke (Inland) | 13/- at ovens — |
| Furnace and Foundry Coke (Export), f.o.b. | 19/- to 19/6 |

CARDIFF— (9) SOUTH WALES.

| | |
|---|---|
| Steam Coals : | |
| Best Smokeless Large | 19/3 to 19/6 |
| Second Smokeless Large | 18/- to 19/- |
| Best Dry Large | 17/9 to 18/6 |
| Ordinary Dry Large | 17/- to 17/3 |
| Best Black Vein Large | 17/6 to 17/9 |
| Western Valley Large | 17/- to 17/3 |
| Best Eastern Valley Large | 16/6 to 17/- |
| Ordinary Eastern Valley Large | 16/3 to 16/6 |
| Best Steam Smalls | 12/6 to 13/- |
| Ordinary Smalls | 10/6 to 12/- |
| Washed Nuts | 16/6 to 18,6 |
| No. 3 Rhondda Large | 19/6 to 20/- |
| ,, ,, Smalls | 14/- to 14/6 |
| No. 2 ,, Large | 16/- to 16/6 |
| ,, ,, Through | 14/6 to 15/6 |
| ,, ,, Smalls | 12/6 to 13/6 |
| Foundry Coke (export) | 27/- to 36/- |
| Furnace Coke (export) | 19/- to 21/- |
| Patent Fuel | 20/6 to 21,6 |
| Pitwood (ex ship) | 29/6 to 30 - |
| SWANSEA— | |
| Anthracite Coals : | |
| Best Big Vein Large | 34/- to 35,6 |
| Seconds | 24/6 to 27/6 |
| Red Vein | 20/6 to 27/- |
| Machine-made Cobbles | 40/- to 43/6 |
| Nuts | 35/- to 43,6 |
| Beans | 23/6 to 26/- |
| Peas | 18/- to 19/- |
| Breaker Duff | 8/- to 8/3 |
| Rubbly Culm | 11/3 to 11/6 |
| Steam Coals : | |
| Large | 17/6 to 18/6 |
| Seconds | 16/- to 17/- |
| Smalls | 10/- to 12/6 |
| Cargo Through | 15/- to 16/- |

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

# French Engineering Notes.

*(From our own Correspondent in Paris.)*

### Motor Cars.

HAVING emerged successfully from the period of inactivity which overtook them when the appreciation of the franc swept away the greater part of the export trade, motor car manufacturers are preparing to meet a particularly serious form of competition which is believed to threaten them from the United States. American firms acquired a great deal of useful publicity when they introduced into this country six-cylinder cars and demonstrated that they could be started and accelerated on top gear, a long time after this had been done by some British makers. The Americans were also believed to be ready to sell their surplus production of cars in Europe at a sacrifice, if necessary. French makers are therefore following the lead of the Americans, much against their will, as the four-cylinder is, after all, a more useful type for the average owner, and at the forthcoming Paris Show there will be a number of new six and eight-cylinder vehicles with all the refinements customary in the high grade American cars. What is more, these same features will be provided in the lighter and cheaper types of vehicles which will reach a larger class of users. It is stated that the builders of the Unic cars will be showing a straight eight-cylinder engined vehicle, and a new type will also be exhibited by Renault, while a great deal of publicity is given to the new six-cylinder car which is to be built in considerable numbers by M. Rosengart, the well-known manufacturers of motor accessories and formerly managing director of the Peugeot Company. Since his retirement from that firm some time ago M. Rosengart has been organising a vast factory for the mass production of small six-cylinder cars which, it is reported, will be sold at a low price. The car to be produced is the Austin, and this further introduction of British designs and methods is testimony to the enterprise of British firms in associating themselves with the French industry. For many years past Austin tractors have been built in France, and since M. W. Morris acquired the Léon Bollée Works at Le Mans, and manufactured the Morris-Léon Bollée car, he has set a new standard in luxurious motor travelling in this country.

### Paris Water Supply.

The Paris Municipal Council apparently hopes to wear down the opposition that has been raised against the scheme for supplying the city with water from the Vals de Loire. An official inquiry is now being instituted in those departments, through which passes the Loire, in order to ascertain the extent and nature of the objections, and if they are found to endanger the carrying out of the scheme, it is probable that the Paris authorities will endeavour to secure the passing of a Bill declaring the scheme to be one of public utility, in which case the objections would be overruled. The water will be pumped from the valley of the Loire where there is a thick stratum of sand overlying an impervious bed. This provides a practically inexhaustible supply of filtered water which only needs to be sent to Paris, mainly by gravitation. It is estimated that more than two million cubic metres of excellent water could be sent to Paris daily without affecting the level of the river. The Paris water engineers have endeavoured to prove this by carrying out pumping operations for close upon eight years, and the quantity was increased until it reached the total of the Paris requirements and was returned to the river some distance lower down. The idea was to show that the underground level of water does not diminish. The scheme is also claimed to have the further advantage of alleviating the floods that cause serious damage over large areas during years of heavy rainfall. For that purpose reservoirs will be constructed, similar to those to be laid out in the valley of the Seine. They will be filled during periods of flood, and the water thus stored will be returned to the river in times of drought.

### Public Transport.

The motor omnibus and tramway services in Paris and the Department of the Seine are in the hands of the Société des Transports en Commun de la Région Parisienne, which thus has a monopoly under the control of the Paris Municipal Council and the Prefect of the Department. The situation of the services became extremely precarious during the period of monetary depreciation, when fares had to be advanced several times and the charging of uniform fares over the entire distance was abandoned in favour of splitting up each line into sections, so that while the minimum fare is rather less than the previous gold value it is really much higher for the longer distances. It is therefore interesting to find from the report just published of the results obtained in 1927 that the motor omnibuses made a small profit. They covered a total distance of 53 million kilometres and carried 330 million passengers. The receipts amounted to 223,523,143 francs and the expenditure to 212,836,454 francs. The tramways, mainly suburban, covered 100 million kilometres and carried 685 million passengers. Their working resulted in a loss. The receipts amounted to 390,547,442 francs and the expenditure to 400,363,196 francs. As a result of the increased fares the total receipts exceeded those of 1926 by 71 million francs, but there was a decline of 7,000,000 in the number of passengers carried.

### Sewage Farms.

Despite the uncompromising opposition of the local populations to the proposal of the Paris Municipal Council to extend the sewage farms along the valley of the Seine, it is reported that the Council is applying for a declaration of public utility, and in view of what is regarded as a serious public danger, particularly in fostering plagues of mosquitoes, a parliamentary group has been formed with the intention of introducing a Bill into the Chamber of Deputies prohibiting the creation of sewage farms in France. It is pointed out that such prohibition exists in Germany and Italy, and that there is no reason why the Paris authorities should not deal with the sewage by bacterial or similar processes with which they have been experimenting for a number of years.

# British Patent Specifications.

*When an invention is communicated from abroad the name and address of the communicator are printed in italics.*

*When an abridgment is not illustrated the Specification is without drawings.*

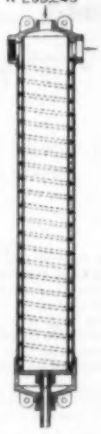
*Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.*

*The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.*

## CONDENSERS AND FEED-WATER HEATERS.

295,245. May 6th, 1927.—APPARATUS FOR HEATING OR COOLING LIQUIDS, Royles, Ltd., and A. G. Royle, Dalham Works, Irlam, Manchester.

N°295,245



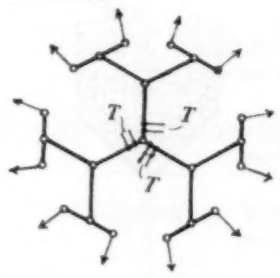
This apparatus comprises two sheet metal tubes, one slightly longer than the other, and also slightly smaller in diameter. The tube of smaller diameter is arranged within the outer tube, and the two tubes are held in their correct relative positions by metal end caps. Prior to applying the caps—or one of them—a long spiral rod is introduced between the two tubes. This rod being equal in diameter to the space between the tubes and forming a close fit against the faces of the tubes. By means of the rod a long spiral passage is produced between the tubes, opening at each end into the interior of the tube end caps. The caps are provided with inlet and outlet branches for the water to be heated and steam is supplied to the inner space. Appropriate proportions for such a heater are given.—*August 7th*, 1928.

## TRANSFORMERS AND CONVERTERS.

295,243. May 5th, 1927.—IMPROVEMENTS RELATING TO TRANSFORMING ELECTRIC CURRENTS, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2; and John Carley Read, The Square, Crewkerne, Somerset.

This invention is especially applicable for producing twelve-phase currents to be used for feeding the anodes of large electric arc or mercury arc rectifiers operating to convert from alternating current to direct current. The scheme for converting three-phase current into twelve-phase current in accordance with this invention is considered to be an improvement on the usual arrangements. The transformer secondary winding com-

N°295,243

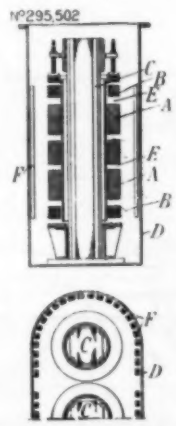



prises three central star-connected sections and to all the free ends of these sections groups of two windings are connected, and these are connected into other winding sections as shown. From the twelve ends of these sections the twelve-phase supply is drawn. Provided the secondary sections are properly interleaved there is only a small direct-current drop of voltage with increasing load, whilst the size of the transformer is not large. Moreover, tappings T may be provided on the three central sections adjacent to the star point of the secondary winding, and these tappings may be used for various purposes, such as "baking out" the rectifier at low voltage or for regulating the direct-current voltage. Several alternative schemes are described. —*August 7th*, 1928.

295,502. July 21st, 1927.—IMPROVEMENTS CONNECTED WITH ENCLOSURES FOR ELECTRIC TRANSFORMERS, The English Electric Company, Ltd., of Queen's House, 28 Kingsway, London, W.C. 2; and Albert Thomas Chadwick, of Siemens Works, Stafford.

The object of this invention is to provide a construction which

N°295,502



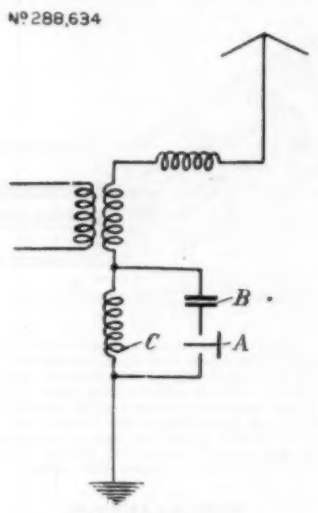

will reduce the losses arising from eddy currents in transformer tanks. The primary windings A and the secondary windings B are placed in the manner shown upon the core legs C which are assembled in the usual manner within the steel tank D. The magnetic leakage fluxes which principally emanate from the spaces E between adjacent sections of the primary and secondary windings are prevented from entering the vertical walls of the tank by means of the packets F of laminations which are spaced a short distance apart and consist of strips of magnetic material having their length in a vertical direction and their planes arranged substantially at right angles to the adjacent part of the wall of the tank. The laminations are generally arranged as near to the tank wall as possible without making contact with the wall surface.—*August 16th*, 1928.

## TELEGRAPHS AND TELEPHONES.

288,634. April 5th, 1928.—IMPROVEMENTS IN OR RELATING TO RADIO AND THE LIKE HIGH-FREQUENCY APPARATUS, Telefunken Gesellschaft für drahtlose Telegraphie m.b.H., of 9, Tempelhofer Ufer, Berlin, Germany.

This invention relates to radio and similar high-frequency apparatus and has for its principal object to provide improved means for effecting keying in such apparatus. The keying is done by means of a switch A—preferably closed during "spacing" periods—in series with a condenser B, the switch

N°288,634



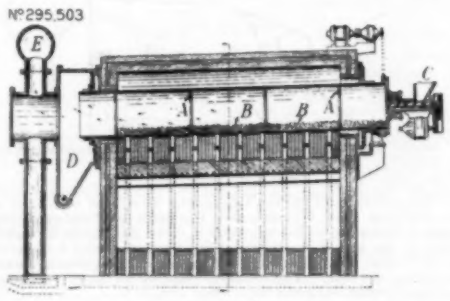

and condenser being connected across an inductance C included as shown in the aerial circuit. Preferably, though not necessarily, the impedance of the condenser B at the working frequency equals that of the inductance C, since with this arrangement most effective de-tuning of the circuit is effected. If desired, the switch A may be adapted simultaneously to control a load compensating resistance provided so that the load upon the transmitter may be maintained substantially constant. The provision of such load-compensating resistances is, of course, well known.—*August 16th*, 1928.

## GAS PRODUCERS.

295,503. July 25th, 1927.—LOW-TEMPERATURE DISTILLATION, J. H. Anderson, 2538, Calvert-avenue, Detroit, Michigan.

In this rotary still there are a number of internal flanges A A, which serve to prevent the charge of metallic grinding lumps B B from escaping at the outlet end. The still is charged at C and is

N°295,503



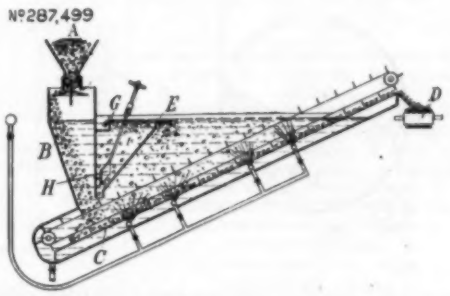

heated externally. The carbonised material works forward over the charge of metallic lumps and is discharged into the box D, while the gas escapes at E. The arrangement is said to prevent the carbonaceous material from becoming coked together and to facilitate the transfer to it of the exterior heat.—*August 16th*, 1928.

## MINING MACHINERY.

287,499. December 6th, 1927.—CLASSIFIERS, Erz-U. Kohle Flotation Gesellschaft mit beschrankter Haftung, Bochum 5, Westphalia, Germany.

It is pointed out in this specification that where hydraulic

N°287,499



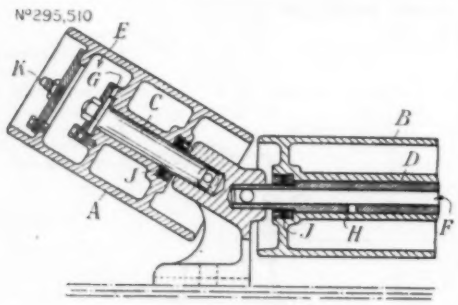

classification of minerals is employed, there is a tendency for the larger particles to drag down with them finer particles, so that the classification is not complete. It is proposed to over-

come this trouble in the following manner. The material to be treated is fed from the hopper A down through the chamber B on to the perforated screen C. Beneath this screen upwardly directed jets of water are supplied, while above it there is a scraper conveyor for carrying away the oversize material to the delivery belt D. Any large particles, together with entrained fines, which leave the screen, flow with the water over the weir E into the chamber below. The fines pass away by the overflow G while the larger stuff gravitates back to the screen. The adjustable wedge H permits the regulation of the outflow of the coarse material and insures the flotation of the fines.—*August 9th*, 1928.

## CRANES AND CONVEYORS.

295,510. August 8th, 1927.—IDLER ROLLERS FOR BELT CONVEYORS, Mavor and Coulson, Ltd., and J. Thomson, 47, Broad-street, Mile End, Glasgow.

According to this invention a roller or its supporting shaft, or each, comprises a reservoir for holding a substantial supply of lubricant, say, oil or grease, hereinafter referred to as oil, and communication is provided for the passage of oil from the reservoir to the bearing surfaces about the shaft upon which the roller rotates, and provision is made for restraining leakage of oil along

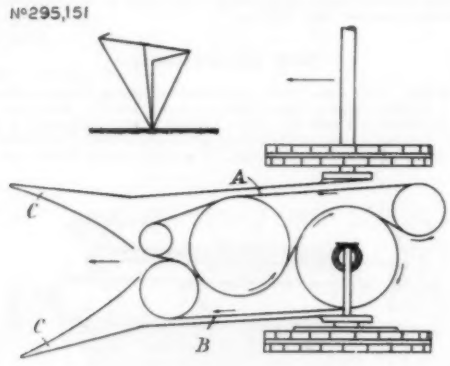



the shaft. The drawing shows inclined rollers A, horizontal rollers B, shafts C for rollers A, shafts D for rollers B, reservoir E for oil in each roller A, reservoir F for oil in each shaft D, passage G for oil from E to bearing surfaces about shaft C, passage H for oil from F to bearing surfaces about shaft D, packing J to restrain leakage of oil along the shafts, oil gun inlets K for oil supply to reservoirs. The shafts C are held against movement endwise and rotation, say, by set screw or key locking. The shaft D is secured endwise in sockets.—*August 16th*, 1928.

## MISCELLANEOUS.

295,151. November 4th, 1927.—MACHINES FOR HARVESTING FLAX, C. J. Bakker, L51, Axel, Holland.

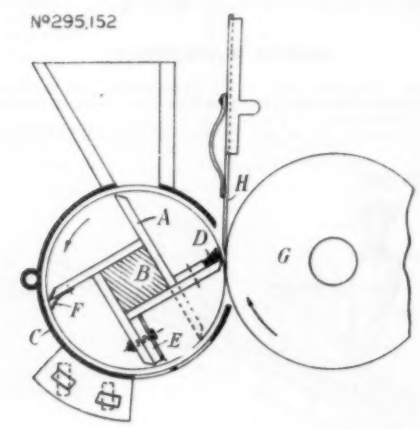
This machine is intended to simulate the action of pulling, or uprooting, flax by hand. The essential feature is a pair of endless bands A and B wrapped round guide rollers, as shown, and driven by gearing from the running wheels of the machine. In front there is a pair of guides C C, which lead the stalks of




the flax plants between the two belts. It will be seen that as the machine goes forward, and the belts go backward, the gripped stems are pulled sideways in both directions, to loosen them in the soil, and are pulled out by the upward inclination of the belts. The uprooted plants are discharged on to the ground at the rear. The small diagram shows the movement of the plant stems.—*August 9th*, 1928.

295,152. November 4th, 1927.—COTTON GINS, A. Libert, 254, Chaussée d'Alsemberg, Forest-Brussels, Belgium.

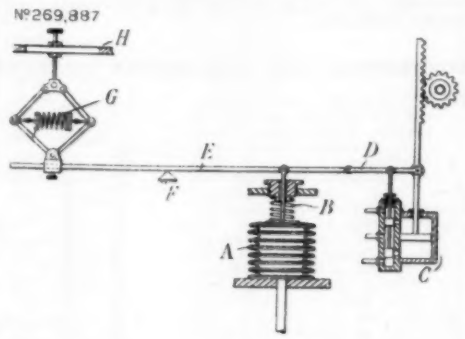
The drawing reproduced shows only the essential features of the beater drum and its adjuncts. The beater blades A are




mounted on a square, or hexagonal, shaft B and rotate within the perforated drum C. The blades may be equipped with brushes as at D, leather flaps E, or resilient strips F. The bolls are fed into the beater drum from the hopper above, and are thrown round on to the leather covered drum G. They are drawn against the doctor knife H, and are stripped of their fibre. The clean seeds escape through the perforations of the drum C, and the cotton is cleaned off the drum G by a wooden doctor knife.—*August 9th*, 1928.

269,887. April 7th, 1927.—ELASTIC CONNECTIONS, *The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C. 2.*

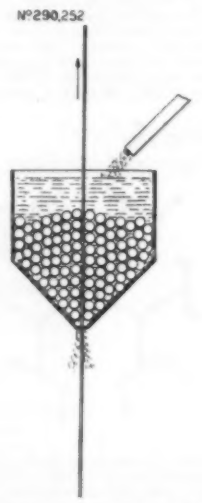
This invention is concerned with such governing devices as may be used for controlling steam turbines, which embody elastic bellows for transmitting the governing pressure. It is explained that ordinarily such bellows have to be inordinately long to provide sufficient flexibility. The pressure of the bellows




A acts against the spring B and is transmitted to the governor servo-motor C by the floating lever D. The lever E, fulcrumed at F, carries at its end a group of four links enclosing a spring G in connection with an abutment H. This spring is "made by winding into it an initial tension equal to the product of its scale and free length." The effect of the spring can be regulated by sliding the framework along the lever E. It is claimed that the mechanism has a straight-line characteristic.—*August 7th*, 1928.

290,252. May 10th, 1928.—IMPROVEMENTS IN OR RELATING TO COATING WIRES AND THE LIKE, *International General Electric Company, Incorporated, of 120, Broadway, New York.*

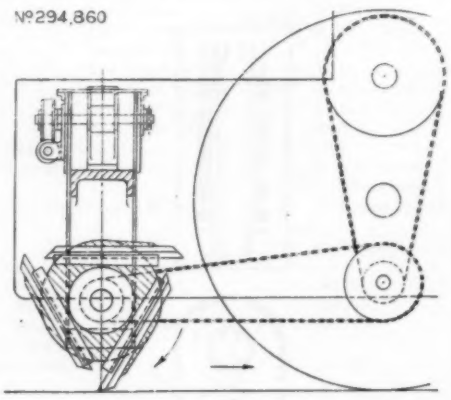
An even insulating coating of enamel on electrically insulated wires, &c., is attained by drawing the wire through a receptacle filled with roughened balls, for instance, glass balls. A current of enamel is caused to flow through the receptacle containing the balls and so that the enamel flows in above the balls, passes through the receptacle and flows out through an opening at or near the bottom. The enamel flowing off is then purified in a special device and again fed to the receptacle containing the




balls. The wire passes through the receptacle in a direction opposite to that of the flow of the enamel. As the wire enters the receptacle containing the balls, first of all the impurities are rubbed off the surface of the wire by the balls and carried off by the stream of enamel flowing in the opposite direction. Immediately after the higher balls rub the enamel on to the already purified wire. Particularly good results are attained, if the wire is allowed previously to pass through a receptacle also containing roughened balls and through which a cleansing liquid is circulated, such, for instance, as tartar, and is then conducted directly to the enamelling ball receptacle.—*August 16th*, 1928.

294,860. March 1st, 1928.—ROAD SCARIFIERS, F. H. Smith, Neuilly, London-road, Higham, Kent.

In this scarifier the tines are mounted on a rotating spindle, much after the fashion of the cutter of a wood planing machine,




The spindle is driven at a considerable speed in the same direction of rotation as the road wheels of the machine. It is claimed that the arrangement has the advantage of the tines cutting away from the solid road into the part already broken up and that shocks to the engine are reduced.—*August 2nd*, 1928.

# Forthcoming Engagements.

*Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the* TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

### TO-DAY.

SOCIETY OF GLASS TECHNOLOGY.—St. Peter's Hall, Bournemouth. "The Value of the Thermal Expansion Factor of Aluminium Oxide in Glass," by Messrs. I. Kitaigorodsky and S. Rodin; "A Study of the Ultra-violet Light Transmission of Glass," by Mr. D. Starkie and Professor W. E. S. Turner. 2 p.m. Public lecture at 4.30 p.m. on "Modern Art Glass," by Professor W. E. S. Turner. Banquet at the Town Hall. 7 for 7.15 p.m.

### WEDNESDAY, SEPTEMBER 5TH, TO SATURDAY, SEPTEMBER 22ND.

**THE FOURTH MACHINE TOOL AND ENGINEERING EXHIBITION at Olympia.**

### MONDAY, SEPTEMBER 24TH, TO SATURDAY, OCTOBER 6TH.

WORLD POWER CONFERENCE.—Fuel Conference. Imperial Institute. For programme see page 719, June 29th.

### TUESDAY AND WEDNESDAY, SEPTEMBER 25TH AND 26TH.

**IRON AND STEEL INSTITUTE—Autumn meeting in Bilbao, Spain. For programme see page 209, August 24th. 10 a.m. each morning.**

### WEDNESDAY, SEPTEMBER 26TH.

INSTITUTION OF PRODUCTION ENGINEERS.—Windsor Room, Grand Hotel, Birmingham. "Problems of Production," by Mr. A. P. Young. 7 p.m.

### THURSDAY, SEPTEMBER 27TH.

INSTITUTION OF LOCOMOTIVE ENGINEERS.—296, Vauxhall Bridge-road. "Some Notes of Metallurgical Importance in Locomotive Engineering," by Mr. B. R. Byrne. 6 p.m.

### FRIDAY AND SATURDAY, SEPTEMBER 28TH AND 29TH.

THE FARADAY SOCIETY.—A general discussion on "Homogeneous Catalysis," to be held in the Physical Chemistry Laboratory of the University of Cambridge.

### MONDAY, OCTOBER 1ST.

THE SOCIETY OF ENGINEERS (INC.).—Burlington House, W. "Pulverised Fuel in Theory and Practice," by Dr. G. E. K. Blythe, Ph.D., &c. 6 p.m.

### TUESDAY, OCTOBER 2ND.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Watergate House, York-buildings, W.C. 2. Presidential address by Mr. L. H. Hounsfield, entitled "The Integrity of the Technical Man." 8 p.m.

### FRIDAY, OCTOBER 5TH.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. "Interesting Details of Swiss Alpine Railways," by Mr. A. J. Simpson. 7.30 p.m.

### SATURDAY, OCTOBER 6TH.

**ELECTRICAL POWER ENGINEERS' ASSOCIATION: SOUTHERN DIVISION.—Hotel Cecil, Strand, W.C. 2. The tenth annual dinner to the members of the National Executive Council, at 5.30 for 6 p.m. Tickets, 7s. 6d., may be obtained from P. Gordon Hieatt, hon. secretary, Southern Division, 25, Parkhurst-road, Bowes Park, N. 22.**

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—North-Western District Meeting at Stockport. Assemble at Stockport Town Hall at 11 a.m.

### MONDAY, OCTOBER 8TH.

THE INSTITUTE OF METALS: SCOTTISH LOCAL SECTION.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. Mr. S. E. Flack, Chairman's address. 7.30 p.m.

### TUESDAY, OCTOBER 9TH.

THE INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. Mr. J. A. Smythe, D.Sc., Ph.D. Chairman's address. 7.30 p.m.

### WEDNESDAY, OCTOBER 10TH.

THE INSTITUTE OF FUEL.—At the Chemical Society's Rooms, Burlington House, Piccadilly, W. 1. Mr. T. A. Peebles, of Pittsburgh, will read a paper on "Automatic Combustion Control of Liquid, Solid and Gaseous Fuels." 6 p.m.

THE INSTITUTE OF METALS: SWANSEA LOCAL SECTION.—In the Thomas Café, High-street, Swansea. Mr. J. H. Grant, A.R.S.M. Chairman's address. 7 p.m.

### THURSDAY, OCTOBER 11TH.

THE INSTITUTE OF METALS: LONDON LOCAL SECTION.—In the Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W. 1. Mr. S. W. Smith, D.Sc., F.I.C. Chairman's address. 7.30 p.m.

### FRIDAY, OCTOBER 12TH.

DIESEL ENGINE USERS ASSOCIATION.—19, Cadogan-gardens, S.W. 13. "Marine Oil Engines," by Mr. Sterry B. Freeman. 5.30 p.m.

THE INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—In the Non-ferrous Section, Applied Science Department of the University, St. George's-square. Mr. R. D. Barklie, M.Sc., A.I.C., "Alternating-current Electrolysis;" also Mr. E. B. Sanigar, Ph.D., M.Sc., A.I.C., "Sodium Cyanide in Silver Plating." 7.30 p.m.

### MONDAY, OCTOBER 15TH.

THE INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—Conjoint meeting in the Non-ferrous Section, Applied Science Department of the University, St. George's-square. Mr. Cosmo Johns, Sorby Lecture, "Influence of Pressure on Rocks and Metals." 7.30 p.m.

### THURSDAY, OCTOBER 18TH.

THE INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—In the Engineers' Club, Waterloo-street. 7 p.m.